

ASGE guideline: the role of endoscopy in the diagnosis, staging, and management of colorectal cancer

This is one of a series of statements discussing the utilization of GI endoscopy in common clinical situations. The Standards of Practice Committee of the American Society for Gastrointestinal Endoscopy prepared this text. In preparing this guideline, a MEDLINE literature search was performed, and additional references were obtained from the bibliographies of the identified articles and from recommendations of expert consultants. When little or no data exist from well-designed prospective trials, emphasis is given to results from large series and reports from recognized experts.

Guidelines for appropriate utilization of endoscopy are based on a critical review of the available data and expert consensus. Further controlled clinical studies are needed to clarify aspects of this statement, and revision may be necessary as new data appear. Clinical consideration may justify a course of action at variance to these recommendations.

Colorectal cancer (CRC) is the 4th most commonly diagnosed cancer and the second leading cause of cancer-related death in the United States.¹ It has been estimated that in 2003 approximately 147,500 cases of CRC were diagnosed and over 57,000 men and women died from this malignancy.¹ During the past decade, great emphasis has been placed on the use of colonoscopy for the early detection and the removal of adenomatous polyps to reduce the incidence and the mortality of CRC. Once CRC has developed, colonoscopy also has an important role in the diagnosis and subsequent disease management. This guideline represents a summary of recommendations on the role of endoscopy in the diagnosis, the staging, and the treatment of CRC. Recommendations for CRC screening and surveillance are discussed in a previous document by the American Society for Gastrointestinal Endoscopy.²

DIAGNOSIS AND TUMOR LOCALIZATION

During colonoscopy, every effort should be made to obtain a tissue diagnosis when encountering polyps, mass

lesions, or colonic strictures. Pathologic confirmation of cancer should always be sought to provide the patient and the physicians the necessary information to make management decisions. In general, polypoid lesions found at the time of colonoscopy should be removed.³ Colonic lesions not amenable to endoscopic resection can be sampled with biopsy forceps. Biopsy specimens of broad sessile lesions or of large mass lesions should be obtained from different areas, including the edges and the center of the lesion, if possible. The addition of cytology brushings to forceps biopsies may increase the diagnostic yield, especially in the setting of obstructing tumors that cannot be traversed.^{4,5}

There are very few well-designed, prospective studies that address the optimal number of endoscopic biopsy specimens necessary to diagnose CRC. In a prospective study of 60 patients with malignant colonic lesions confirmed by surgical pathology, 4 biopsy specimens obtained during colonoscopy yielded a diagnosis of CRC in 68%, whereas 6 biopsy specimens yielded a diagnosis in 78%.⁶ There was no additional diagnostic yield from obtaining more than 6 biopsy specimens. In cases where endoscopic biopsy specimens are nondiagnostic and cancer is highly suspected, clinicians should consider obtaining a second opinion from an expert pathologist³ and/or performing repeat colonoscopy for additional tissue sampling. Surgery is indicated for suspicious lesions with nondiagnostic biopsy specimens.

EMR can be selectively used in the removal of colonic lesions that may potentially be malignant or may have high-grade dysplasia (HGD).⁷⁻⁹ EMR differs from standard snare polypectomy by the use of submucosal solution injection, which allows for the complete resection of the mucosa through the mid to deep submucosa.¹⁰ The inability to raise the base of a polyp after submucosal solution injection can indicate the presence of cancer invading deep into the submucosa and precludes endoscopic resection of the lesion.¹¹ The use of chromoendoscopy with or without high-resolution endoscopes or magnifying endoscopes can assist in characterizing and delineating colonic lesions before EMR and may be helpful in predicting histopathology based on topography and pit pattern.¹²⁻¹⁵ EUS also can serve as a useful tool in the evaluation of colonic lesions before EMR by determining depth of invasion and by detecting the presence of lymph nodes that may indicate malignancy. In one study, the

TABLE 1. TNM Staging Classification of Colorectal Cancer

| | |
|--------------------------|---|
| Primary tumor (T) | |
| TX | Primary tumor cannot be assessed |
| T0 | No evidence of primary tumor |
| Tis | Carcinoma in situ: intraepithelial or invasion of lamina propria |
| T1 | Tumor invades submucosa |
| T2 | Tumor invades muscularis propria |
| T3 | Tumor invades through the muscularis propria into the subserosa or into nonperitonealized pericolic or perirectal tissues |
| T4 | Tumor directly invades other organs or structures, and/or perforates visceral peritoneum |
| Regional lymph nodes (N) | |
| NX | Regional lymph nodes cannot be assessed |
| N0 | No regional lymph-node metastasis |
| N1 | Metastasis in 1 to 3 regional lymph nodes |
| N2 | Metastasis in 4 or more regional lymph nodes |
| Distant metastasis (M) | |
| MX | Distant metastasis cannot be assessed |
| M0 | No distant metastasis |
| M1 | Distant metastasis |

accuracy of EUS for determining intramucosal location of colonic neoplasms was 77%.¹⁶

In addition to its role in the diagnosis of CRC, colonoscopy has an important role in the localization of malignant lesions for subsequent identification at the time of surgery. Preoperative endoscopic marking can be helpful in localizing flat, small, or subtle colonic lesions that may be difficult to identify by inspection or palpation during surgery. Marking techniques currently available include endoscopic tattooing and metallic clip placement.¹⁷⁻¹⁹

Staging of rectal cancer

Colorectal cancer is staged according to the TNM system established by the American Joint Committee on Cancer and the International Union Against Cancer (Table 1).²⁰ Preoperative staging of rectal cancer is necessary to determine patient management. In 1990, the

National Institutes of Health Consensus Conference recommended adjuvant chemoradiation therapy for those patients with advanced locoregional rectal cancer.²¹ Advanced locoregional cancers are defined as those tumors with extension into the perirectal fat (stage T3 N0 or T4 N0) and/or involvement of mesorectal or pelvic lymph nodes (stage TX N1 or TX N2). Several large studies have demonstrated a significant decrease in local cancer recurrence associated with preoperative radiation therapy in patients with advanced locoregional disease.²²⁻²⁵ A small number of studies also suggest that there may be a survival benefit associated with preoperative radiation therapy for advanced locoregional disease.^{26,27} Accurate tumor staging is essential for selecting the surgical approach to rectal cancers.^{28,29} Superficially, invasive small cancers (stage T1 N0 or selected T2 N0) may be resected transanally. More deeply invasive and node-positive cancers require low anterior resection or abdominoperineal resection, depending upon their location within the rectum.

The accuracy of EUS for T staging ranges from 80% to 95%.³⁰ EUS has been demonstrated to be superior to CT in determining the T stage of rectal cancer.³¹⁻³⁴ Magnetic resonance imaging with endorectal coils has been compared with EUS in several small series of patients and appears to have similar accuracy for T staging except in differentiating between T1 and T2 tumors, where EUS may be superior.³⁵⁻³⁷ Abdominal CT, in combination with EUS, appears to be the most cost-effective strategy in staging rectal cancer.³⁸

Correctly differentiating benign from malignant perirectal lymphadenopathy by EUS is difficult, because inflammatory nodes may be present in the setting of rectal cancer. The accuracy of EUS in nodal staging ranges from 70% to 75%.³⁰ The sensitivity of EUS for identifying metastatic lymph nodes appears to decrease in nodes measuring less than 5 mm.^{39,40} EUS-guided FNA of perirectal lymph nodes may be most helpful in the setting of T1 or T2 disease in which the presence of malignant perirectal lymph nodes would change patient management to include preoperative chemoradiation therapy.²⁹

Malignant strictures in the rectum that are not traversable may be difficult to evaluate by EUS. The use of miniprobe advanced through the endoscope channel or rigid rectal EUS probes may be helpful in these cases.^{41,42} The inability to completely transverse a cancerous lesion can result in understaging of the tumor. Stricture dilation before EUS is infrequently performed, however, this issue has not been studied. As seen in esophageal cancers, the finding of a nontraversable malignant stricture in the rectum may be predictive of advanced tumor stage (T3, T4 or TX, N1, N2).^{43,44}

The utility of EUS in restaging rectal cancer after preoperative radiation therapy for advanced locoregional disease is not clear. EUS restaging after radiation therapy can provide a measure of the treatment response, which

may, in turn, change the surgical approach taken in selected cases. However, the accuracy of EUS in determining the extent of tumor invasion markedly decreases to 40% to 50% after radiation, because of inflammatory changes and fibrosis.^{45,46}

The role of EUS in the postoperative surveillance of rectal cancer has not been clearly defined. Local recurrence of rectal cancer after surgical resection occurs in 10% to 30% of patients, depending on stage and therapy given.^{22,27} Tumor recurrence often may present extraluminally and can be missed by routine surveillance with digital rectal examination and colonoscopy. The early detection of local cancer recurrence may lead to potentially curative surgical re-excision. Several studies have recently demonstrated that EUS and EUS-guided FNA are highly sensitive methods for the detection and the diagnosis of regional recurrence,⁴⁷⁻⁵² although their impact on long-term survival is not known, and the optimal timing and frequency of EUS examination has not been studied.

Endoscopic management of malignant colonic obstruction

Malignant obstruction of the colon can occur in 8% to 30% of patients with colorectal cancer.⁵³ Endoscopic management of malignant obstruction with laser therapy or stent placement offers a safe and an effective alternative to surgery. Currently, there are two main indications for the endoscopic management of colonic obstruction: temporary colonic decompression as a bridge to surgery and palliation of patients who are deemed poor surgical candidates or who have incurable disease.⁵⁴ Successful endoscopic decompression of acute obstruction allows for the stabilization of the patient and for evaluation of the patient's extent of disease and comorbid illnesses before surgery. In operative candidates, acute decompression avoids the need for a diverting colostomy and a second surgery for reanastomosis, because the tumor can be resected during a one-stage procedure after adequate bowel preparation.

Laser therapy has a high success rate in the treatment of malignant colonic obstruction ranging from 80% to 90%. In a large retrospective study of 272 patients treated with a neodymium-yttrium aluminum garnet laser for obstructing rectosigmoid tumors, successful relief of the obstruction was achieved in 85% of patients.⁵⁵ The success of the procedure appears to be associated with tumor size, with large mass lesions being less likely to respond to treatment.⁵⁶ The procedure may require several sessions to successfully relieve the obstruction, and repeat therapy may be needed for recurrent obstruction because of tumor regrowth. The most common complications associated with laser treatment include perforation, bleeding, fistula formation, pelvic abscesses, and pain.⁵⁷

The placement of self-expandable metal stents (SEMS) has recently evolved into a more widely used method of

endoscopic colonic decompression. The success rate of stent deployment and the relief of malignant colonic obstruction has been reported to range from 70% to 95%. In a systematic review of publications on colonic SEMS from 1990 to 2000, endoscopic stent placement was successful in cancer palliation in 90% of 336 reported cases of incurable obstructing cancer.⁵⁸ The use of SEMS for the management of acute colonic obstruction as a bridge to surgery appears to significantly reduce the rate of postoperative complications, including wound infections and intra-abdominal abscesses when compared with primary surgery.⁵⁹ In two recent studies comparing preoperative decompression with SEMS placement with surgery, patients treated with SEMS had a significantly lower requirement for diverting colostomy and subsequently had shorter total hospital stay, fewer surgeries, and fewer complications.^{60,61} Despite the benefits of preoperative SEMS placement for resectable patients, there does not appear to be an improvement in overall survival after long-term follow-up.⁵⁹ Recently, a small retrospective study suggested that SEMS placement offers a significant cost benefit in the management of malignant colonic obstruction by avoiding diverting colostomy and a two-stage operation in surgical candidates.⁶⁰ Alternatively, a study evaluating the cost-effectiveness of SEMS placement vs. surgery for incurable obstructing cancers demonstrated similar total costs for both treatment options, given the significant cost of the metal endoprosthesis and the additional cost of endoscopic management of recurrent obstruction caused by tumor ingrowth and overgrowth of the stent.⁶²

The major complications associated with colonic stenting include perforation, bleeding, tumor ingrowth or overgrowth, and stent migration. Dilation of the malignant stricture does not appear to be necessary before SEMS placement and may be associated with a higher risk of perforation.⁶³ Treatment with chemotherapy and radiation therapy after SEMS placement may be associated with an increased risk of complications, e.g., stent migration; however, this has not been well studied.⁶³ Stent obstruction can occur because of stool impaction, tumor ingrowth, or tumor overgrowth, which all require endoscopic intervention. Tumor ingrowth or overgrowth can be managed by placement of additional stents through the original stent(s)⁵⁴ or by treatment with neodymium-yttrium aluminum garnet laser. Patients should be advised to follow a low residue diet and to take laxatives, stool softeners, or mineral oil supplements to avoid stool impaction after SEMS placement.⁶³

Endoscopic management of malignant colonic polyps and polyps with HGD

Invasive carcinoma may be found in approximately 2% to 4% of colonic polyps removed endoscopically. Polypectomy or EMR may be curative in selected, superficially

TABLE 2. Unfavorable histopathologic factors of malignant colonic polyps associated with high risk of lymph-node metastases and local cancer recurrence after endoscopic resection*

| |
|--|
| Poorly differentiated histology |
| Vascular invasion |
| Lymphatic invasion |
| Cancer involvement of the resection margin |
| Incomplete endoscopic resection |

*Polyps described refer to malignant colonic polyps confined to the submucosa without invasion of the muscularis propria or deeper wall layers.

invasive colon cancers. A malignant polyp is defined as one containing invasive carcinoma penetrating through the muscularis mucosa into the submucosa. The reported rates of local lymph-node metastases associated with malignant polyps confined to the submucosa vary widely in several case series because of the heterogeneity of the histopathologic features of the cancers described.⁶⁴⁻⁶⁶ In a retrospective study of 353 cases of T1 cancers removed surgically, lymph-node metastases were found in 13% of cases.⁶⁷ This study demonstrated that the rate of lymph-node metastasis was significantly associated with the depth of tumor invasion within the submucosa, with tumors invading the upper third, middle third, and lower third of the submucosa, having 2%, 9%, and 35% rates of lymph-node metastasis, respectively. There are several histologic factors that also appear to be associated with a higher risk of lymph-node metastasis and local cancer recurrence after endoscopic resection of malignant polyps confined to the submucosa, including the following: poorly differentiated histology, vascular or lymphatic invasion, positive resection margins, and incomplete resection (Table 2).^{65,67,68} Pedunculated polyps with cancer confined to the submucosa and without evidence of unfavorable histologic factors have a 0.3% risk of cancer recurrence or lymph-node metastasis after complete endoscopic removal, whereas similar sessile polyps have a 4.8% risk.⁶⁹ Pedunculated polyps confined to the submucosa, with no evidence of unfavorable histologic features, can be definitively treated with endoscopic resection, without the need for surgical resection.² In cases of pedunculated polyps harboring unfavorable histologic features, demonstrating cancer within the resection margin, or extending through the submucosa into the deeper wall layers, surgery is recommended. Malignant sessile polyps confined to the submucosa, removed endoscopically en bloc (not piecemeal), and without evidence of unfavorable histologic features have a small increased risk of lymph-node metastasis compared with similar pedunculated polyps. Therefore, surgical

resection should be considered in this subset of malignant sessile polyps, while recognizing that in most of these cases endoscopic resection is probably adequate.² Surgery is indicated in cases of sessile polyps harboring unfavorable histologic features or demonstrating cancer through the submucosa into the deeper wall layers. Surgery should also be recommended in cases in which the sessile lesion was removed in a piecemeal fashion, and, therefore, the adequacy of the resection margin cannot be determined. The finding of a malignant polyp in patients with ulcerative colitis or Crohn's colitis should be considered an indication for total colectomy. Endoscopic resection of malignant polyps with unfavorable histologic features or piecemeal resection of large malignant polyps can be considered in patients deemed poor surgical candidates because of comorbid illnesses. Surveillance after the endoscopic removal of a malignant polyp should consist of a follow-up colonoscopy within 3 to 6 months after resection.

Polypectomy or EMR also can be used as the primary management of polypoid lesions with HGD. Previously known as carcinoma in situ or intramucosal cancer, HGD currently is defined as dysplastic neoplastic tissue confined within the mucosal wall layers without invasion of the submucosa.⁷⁰ Endoscopic removal of lesions with HGD is adequate, provided that the endoscopist is confident in the completeness of resection. Surveillance after the endoscopic resection of a lesion with HGD should consist of repeat colonoscopy in 3 years.^{2,3,71,72} In the case of large sessile lesions, lesions removed in a piecemeal fashion, or when the endoscopist is unsure of the completeness of resection, repeat colonoscopy or flexible sigmoidoscopy should be performed within 3 to 6 months to rule out residual neoplastic tissue at the polypectomy site. If residual tissue is identified, this should be removed and a second follow-up examination should be performed within 3 to 6 months to verify complete resection. If a polyp cannot be removed completely within 1 to 3 examinations, surgery is recommended.^{2,71}

SUMMARY

For the following points: (A), prospective controlled trials; (B), observational studies; (C), expert opinion.

- Colonoscopy is essential in the diagnosis of CRC. (B)
- Multiple biopsy specimens should be obtained from all suspicious lesions, and polypoid lesions should be removed. (A)
- EUS is accurate in the preoperative locoregional staging of rectal cancer and is useful in guiding therapy. (A)
- Malignant colonic obstruction can be effectively treated endoscopically for palliation or as a bridge to surgery with SEMS or laser therapy. (B)

- Unfavorable histopathologic factors of malignant colonic polyps associated with a high risk of lymph-node metastasis or local recurrence after endoscopic resection include the following: poorly differentiated histology, vascular or lymphatic invasion, cancer at the resection margin, and incomplete resection. (B)
- Malignant pedunculated polyps confined to the submucosa can be considered to be adequately treated by endoscopic resection if removed completely and if there is no evidence of unfavorable histologic features. (B)
- Malignant sessile polyps confined to the submucosa and demonstrating no evidence of unfavorable histologic factors have a small increased risk of lymph-node metastasis and local recurrence compared with similar pedunculated polyps after endoscopic resection. Endoscopic resection of this subset of sessile polyps may be adequate if the resection was complete and en bloc; however, surgical resection should be considered to ensure definitive treatment. (B)
- HGD can be adequately treated with endoscopic resection. (B)

REFERENCES

- Jemal A, Murray T, Samuels A, Ghafoor A, Ward E, Thun MJ. Cancer statistics, 2003. *CA Cancer J Clin* 2003;53:5-26.
- Eisen GM, Chutkan R, Goldstein JL, Petersen BT, Ryan ME, Sherman S, et al. American Society for Gastrointestinal Endoscopy. Guidelines for colorectal cancer screening and surveillance. *Gastrointest Endosc* 2000;51:777-82.
- Rex DK, Bond JH, Winawer S, Levin TR, Burt RW, Johnson DA, et al. Quality in the technical performance of colonoscopy and the continuous quality improvement process for colonoscopy; recommendations of the U.S. multi-society task force on colorectal cancer. *Am J Gastroenterol* 2002;97:1296-308.
- Mortensen NJ, Eltringham WK, Mountford RA, Lever JV. Direct vision brush cytology with colonoscopy: an aid to the accurate diagnosis of colonic strictures. *Br J Surg* 1984;71:930-2.
- Jeevanandam V, Treat MR, Forde KA. A comparison of direct brush cytology and biopsy in the diagnosis of colorectal cancer. *Gastrointest Endosc* 1987;33:370-1.
- Marshall JB, Diaz-Arias AA, Barthel JS, King PD, Butt JH. Prospective evaluation of optimal number of biopsy specimens and brush cytology in the diagnosis of cancer of the colorectum. *Am J Gastroenterol* 1993;88:1352-4.
- Binmoeller KF, Bohnacker S, Seifert H, Thonke F, Valdeyar H, Soehendra N. Endoscopic snare excision of giant colorectal polyps. *Gastrointest Endosc* 1996;43:183-8.
- Tanaka S, Haruma K, Oka S, Takahashi R, Kunihiro M, Kitadai Y, et al. Clinicopathologic features and endoscopic treatment of superficially spreading colorectal neoplasms larger than 20 mm. *Gastrointest Endosc* 2001;54:62-6.
- Kanamori T, Itoh M, Yokoyama Y, Tsuchida K. Injection-incision-assisted snare resection of large sessile colorectal polyps. *Gastrointest Endosc* 1996;43:183-95.
- Nelson DB, Block KP, Bosco JJ, Burdick JS, Curtis WD, Faigel DO, et al. Technology status evaluation report: endoscopic mucosal resection. *Gastrointest Endosc* 2000;52:860-3.
- Uno Y, Manukat A. The non-lifting sign of invasive colon cancer. *Gastrointest Endosc* 1994;40:485-9.
- Carr-Locke DL, Al-Kawas FH, Branch MS, Byrne WJ, Edumundowicz SA, Jamidar PA, et al. Technology status evaluation report: endoscopic tissue staining and tattooing. *Gastrointest Endosc* 1996;43:652-7.
- Nelson DB, Block KP, Bosco JJ, Burdick JS, Curtis WD, Faigel DO, et al. High-resolution and high-magnification endoscopy: September 2000. *Gastrointest Endosc* 2000;52:864-6.
- Konishi K, Kaneko K, Kurahashi T, Yamamoto T, Kushima M, Kanda A, et al. A comparison of magnifying and nonmagnifying colonoscopy for diagnosis of colorectal polyps: a prospective study. *Gastrointest Endosc* 2003;57:48-53.
- Saitoh Y, Obara T, Watari J, Nomura M, Taruishi M, Orii Y, et al. Invasion depth diagnosis of depressed type early colorectal cancers by combined use of videoendoscopy and chromoendoscopy. *Gastrointest Endosc* 1998;48:362-70.
- Hizawa K, Suekane H, Aoyagi K, Matsumoto T, Nakamura S, Masatoshi F. Use of endosonographic evaluation of colorectal tumor depth in determining the appropriateness of endoscopic mucosal resection. *Am J Gastroenterol* 1996;91:768-71.
- Ginsberg GG, Barkun AN, Bosco JJ, Burdick JS, Isenberg GA, Nakao NL, et al. Technology status evaluation report: endoscopic tattooing. *Gastrointest Endosc* 2002;55:811-4.
- Kim SH, Milsom JW, Church JM, Ludwig KA, Garcia-Ruiz A, Okuda J, et al. Perioperative tumor localization for laparoscopic colorectal surgery. *Surg Endosc* 1997;11:1013-6.
- Montorsi M, Opocher E, Santambrogio R, Bianchi P, Faranda C, Arcidacono P, et al. Original technique for small colorectal tumor localization during laparoscopic surgery. *Dis Colon Rectum* 1999;42:819-22.
- Greene FL, Page DL, Fleming ID, Fritz AG, Balch CM, Haller DG, et al. AJCC cancer staging handbook. 6th ed. Philadelphia: Lippincott Raven; 2002.
- National Institutes of Health consensus conference. Adjuvant therapy for patients with colon and rectal cancer. *JAMA* 1990;264:1444-50.
- Pahlman L, Glimelius B. Pre- or postoperative radiotherapy in rectal and rectosigmoid carcinoma. Report from a randomized multicenter trial. *Ann Surg* 1990;211:187-95.
- Frykholm GJ, Glimelius B, Pahlman L. Preoperative or postoperative irradiation in adenocarcinoma of the rectum: final treatment results of a randomized trial and an evaluation of late secondary effects. *Dis Colon Rectum* 1993;36:564-72.
- Medical Research Council Rectal Cancer Working Party. Randomised trial of surgery alone versus radiotherapy followed by surgery for potentially operable locally advanced rectal cancer. *Lancet* 1996;348:1605-10.
- Kapiteijn E, Marijnen CA, Nagtegaal ID, Putter H, Steup WH, Wiggers T, et al. Preoperative radiotherapy combined with total mesorectal excision for resectable rectal cancer. *N Engl J Med* 2001;345:638-46.
- Camma C, Giunta M, Fiorica F, Pagliaro L, Craxi A, Cottone M. Preoperative radiotherapy for resectable rectal cancer: a meta-analysis. *JAMA* 2000;284:1008-15.
- Improved survival with preoperative radiotherapy in resectable rectal cancer. Swedish Rectal Cancer Trial. *N Engl J Med* 1997;336:980-7.
- Lee P, Oyama K, Homer L, Sullivan E. Effects of endorectal ultrasonography in the surgical management of rectal adenomas and carcinomas. *Am J Surg* 1999;177:388-91.
- Harewood GC, Wiersema MJ, Nelson H, Maccarty RL, Olson JE, Clain JE, et al. A prospective, blinded assessment of the impact of preoperative staging on the management of rectal cancer. *Gastroenterology* 2002;123:24-32.
- Wiersema MJ, Harewood GC. Endoscopic ultrasound for rectal cancer. *Gastroenterol Clinics N Am* 2002;31:1093-105.
- Beynon J, Mortesen NJ, Foy DM, Channer JL, Virjee J, Goddard P. Preoperative assessment of local invasion in rectal cancer: digital examination, endoluminal sonography or computed tomography. *Br J Surg* 1986;73:1015-7.

32. Rifkin MD, Ehrlich SM, Marks G. Staging of rectal carcinoma: prospective comparison of endorectal US and CT. *Radiology* 1989; 170:319-22.
33. Herzog U, von Flue M, Tondelli P, Schuppisser JP. How accurate is endorectal ultrasound in the preoperative staging of rectal cancer? *Dis Colon Rectum* 1993;36:127-34.
34. Osti MF, Padovan FS, Pirolli C, Sbarbati S, Tombolini V, Meli C, et al. Comparison between transrectal ultrasonography and computer tomography with rectal inflation of gas in preoperative staging of lower rectal cancer. *Eur Radiol* 1997;7:26-30.
35. Zagoria RJ, Schlarb CA, Ott DJ, Bechtold RE, Wolfman NT, Scharling ES, et al. Assessment of rectal tumor infiltration utilizing endorectal MR imaging and comparison with endoscopic rectal sonography. *J Surg Oncol* 1997;64:312-7.
36. Gualdi GF, Casciani E, Guadalaxara A, d'Orta C, Poletti E, Pappalardo G. Local staging of rectal cancer with transrectal ultrasound and endorectal magnetic resonance imaging: comparison with histologic findings. *Dis Colon Rectum* 2000;43:338-45.
37. Meyenberger C, Huch Boni RA, Bertschinger P, Zala GF, Klotz HP, Krestin GP. Endoscopic ultrasound and endorectal magnetic resonance imaging: a prospective, comparative study for preoperative staging and follow-up of rectal cancer. *Endoscopy* 1995;27:469-79.
38. Harewood GC, Wiersema MJ. Cost-effectiveness of endoscopic ultrasonography in the evaluation of proximal rectal cancer. *Am J Gastroenterol* 2002;97:874-82.
39. Nielsen MB, Qvitzau S, Pedersen JF. Detection of pericolic lymph nodes in patients with colorectal cancer: an in vitro and in vivo study of the efficacy of endosonography. *AJR Am J Roentgenol* 1993;161: 57-60.
40. Spinelli P, Schiavo M, Meroni E, Di Felice G, Andreola S, Gallino G, et al. Results of EUS in detecting perirectal lymph node metastases of rectal cancer: the pathologist makes the difference. *Gastrointest Endosc* 1999;49:754-8.
41. Hunerbein M, Totkas S, Ghadimi B, Schlag P. Preoperative evaluation of colorectal neoplasms by colonoscopic miniprobe ultrasonography. *Ann Surg* 2000;232:46-50.
42. Nielson MB, Pederson JF, Christiansen J. Rectal endosonography in the evaluation of stenotic rectal tumors. *Dis Colon Rectum* 1993;36:275-9.
43. Van Dam J, Rice TW, Catalano MF, Kirby T, Sivak MV. High-grade malignant stricture is predictive of esophageal tumor stage. *Cancer* 1993;71:2910-7.
44. Miyamoto S, Boku N, Fujii T, Ohtsu A, Matsumoto S, Tajiri H, et al. Macroscopic typing with wall stricture sign may reflect tumor behaviors of advanced colorectal cancers. *J Gastroenterol* 2001;36:158-65.
45. Napoleon B, Pujol B, Berger F, Valette PJ, Gerard JP, Souquet JC. Accuracy of endosonography in the staging of rectal cancer treated by radiotherapy. *Br J Surg* 1991;78:785-8.
46. Gavioli M, Bagni A, Piccagli I, Fundaro S, Natalini G. Usefulness of endorectal ultrasound after preoperative radiotherapy in rectal cancer. Comparison between sonographic and histopathologic changes. *Dis Colon Rectum* 2000;43:1075-83.
47. Lohner MS, Doniec JM, Henne-Bruns D. Effectiveness of endoluminal sonography in the identification of occult local rectal cancer recurrences. *Dis Colon Rectum* 2000;43:483-91.
48. Rotondano G, Esposito P, Pellicchia L, Novi A, Romano G. Early detection of locally recurrent rectal cancer by endosonography. *Br J Radiol* 197;70:567-71.
49. Mascagni D, Corbellini L, Urciuoli P, DiMatte G. Endoluminal ultrasound for early detection of local recurrence of rectal cancer. *Br J Surg* 1989;76:1176-80.
50. Hunerbein M, Totkas S, Moesta KT, Ulmer C, Handke T, Schlang PM. The role of transrectal ultrasound-guided biopsy in the postoperative follow-up of patients with rectal cancer. *Surgery* 2001;129:164-9.
51. Muller C, Kahler G, Scheele J. Endosonographic examination of gastrointestinal anastomoses with suspected locoregional recurrence. *Surg Endosc* 2000;14:45-50.
52. Ramirez JM, Mortesen NJ, Takeuch N, Humphreys MM. Endoluminal ultrasonography in the follow-up of patients with rectal cancer. *Br J Surg* 1994;81:692-4.
53. Deans GT, Krukowski H, Irwing T. Malignant obstruction of the left colon. *Br J Surg* 1994;81:1270-6.
54. Baron TH, Harewood GC. Technological review: enteral self-expandable stents. *Gastrointest Endosc* 2003;58:421-33.
55. Brunetaud JM, Maunoury V, Cochelard D. Lasers in rectosigmoid tumors. *Semin Surg Oncol* 1995;11:319-27.
56. Loizou LA, Grigg D, Boulos PB, Bown SG. Endoscopic Nd:YAG laser treatment of rectosigmoid cancer. *Gut* 1990;31:812-6.
57. Gevers AM, Macken E, Hiele M, Rutgeerts P. Endoscopic laser therapy for palliation of patients with distal colorectal carcinoma: analysis of factors influencing long-term outcome. *Gastrointest Endosc* 2000;51: 580-5.
58. Khot UP, Lang AW, Murali K, Parker MC. Systematic review of the efficacy and safety of colorectal stents. *Br J Surg* 2002;89:1096-102.
59. Saida Y, Sumiyama Y, Nagao J, Uramatsu M. Long-term prognosis of preoperative "bridge to surgery" expandable metallic stent insertion for obstructive colorectal cancer: comparison with emergency operation. *Dis Colon Rectum* 2003;46:S44-9.
60. Binkert CA, Ledermann H, Jost R, Saurenmann P, Decurtins M, Zollikofer CL. Acute colonic obstruction: clinical aspects and cost-effectiveness of preoperative and palliative treatment with self-expanding metallic stents: a preliminary report. *Radiology* 1998;206: 199-204.
61. Martinez-Santos C, Lobato RF, Fradejas JM, Pinto I, Ortega-Deballon P, Moreno-Azcoita M. Self-expandable stent before elective surgery vs. emergency surgery for the treatment of malignant colorectal obstructions: comparison of primary anastomosis and morbidity rates. *Dis Colon Rectum* 2002;45:401-6.
62. Xinopoulos D, Dimitroulopoulos D, Theodosopoulos T, Tsamakidis K, Bitsakou G, Plataniotis G, et al. Stenting or stoma creation for patients with inoperable malignant colonic obstructions? Results of a study and cost-effectiveness analysis. *Surg Endosc* 2004;18: 421-6.
63. Baron TH, Dean PA, Yates MR, Canon C, Koehler RE. Expandable metal stents for the treatment of colonic obstruction: techniques and outcomes. *Gastrointest Endosc* 1998;47:277-86.
64. Cooper HS. Surgical pathology of endoscopically removed malignant polyps of the colon and rectum. *Am J Surg Pathol* 1983;7:613-23.
65. Morson BC, Whiteway JE, Jones EA, Macrae FA, Williams CB. Histopathology and prognosis of malignant colorectal polyps treated by endoscopic polypectomy. *Gut* 1984;25:437-44.
66. Coverlizza S, Risio M, Ferrari A, Fenoglio-Preiser M, Rossini FP. Colorectal adenomas containing invasive carcinoma. *Cancer* 1989;64: 1937-89.
67. Nascimbeni R, Burgart LJ, Nivatvongs S, Larson D. Risk of lymph node metastasis in T1 carcinoma of the colon and rectum. *Dis Colon Rectum* 2002;45:200-6.
68. Muller S, Chesner IM, Egan MJ, Rowlands DC, Collard MJ, Swarbrick ET, et al. Significance of venous and lymphatic invasion in malignant polyps of the colon and rectum. *Gut* 1989;30:1385-91.
69. Cranley JP, Petras RE, Carey WD, Paradis K, Sivak MV. When is endoscopic polypectomy adequate therapy for colonic polyps containing invasive carcinoma? *Gastroenterology* 1986;91:419-27.
70. Pascal RR. Dysplasia and early carcinoma in inflammatory bowel disease and colorectal adenomas. *Hum Pathol* 1994;25:1160-71.
71. Bond JH. Polyp guideline: diagnosis, treatment, and surveillance for patients with colorectal polyps. Practice parameters committee of the American College of Gastroenterology. *Am J Gastroenterol* 2000;95: 3053-63.
72. Smith RA, von Eschenbach AC, Wender R, Levin B, Byers T, Rothenberger D, et al. American Cancer Society guidelines for the early detection of cancer: update of early detection guidelines for prostate, colorectal, and endometrial cancers. *CA Cancer J Clin* 2001; 51:38-75.

Prepared by:

STANDARDS OF PRACTICE COMMITTEE

Raquel E. Davila, MD

Elizabeth Rajan, MD

Douglas Adler, MD

William K. Hirota, MD

Brian C. Jacobson, MD, MPH

Jonathan A. Leighton, MD

Waqar Qureshi, MD

Marc J. Zuckerman, MD

Robert Fanelli, MD, SAGES Representative

David Hambrick, RN, CGRN, SGNA Representative

Todd H. Baron, MD, Vice Chair

Douglas O. Faigel, MD, Chair
