Chapter 10
Colorectum: Mucosal Neoplasias

Frieder Berr, Toshio Uraoka, and Naohisa Yahagi

10.1 Introduction

The *majority of lesions* detected on screening colonoscopy are *protruded-type polyps* (0–Ip/Isp/Is): about a *third* of them are *hyperplastic* (nonneoplastic), and the remaining two thirds are neoplastic, i.e., adenomas or carcinomas [1, 2]. The probability of detecting small and minute neoplasias is much higher for protruded lesions than for flat-type lesions [1, 3]. But 50 % of CRC originate from flat precursors [4].

The importance of flat- and depressed-type lesions, well known in Japan [5], had first been proven in Western patients in a prospective study of 1,000 routine colonoscopies in Leeds/UK. Apart from 2.5 % advanced carcinomas, a total of 327 neoplasias (including 6 early CRC) had been detected with 62 % polypoid-, 36 % flat-, and 1.2 % depressed-type morphology. HGIN or carcinomas were present in 8 % of polypoid-, 14 % of flat-, and 75 % of depressed-type neoplasias [6]. Hence, the *risk* of containing cancer cells is very low in small protruded neoplasias but *high in flat* and particularly in *depressed* neoplasias [3, 5]. Therefore, we must be aware of the spectrum and different malignant potential of neoplastic lesions.

F. Berr
Department of Internal Medicine I, Paracelsus Medical University/Salzburger Landeskliniken, Muellner Hauptstrasse 48, 5020 Salzburg, Austria

T. Uraoka
Department of Gastroenterology, Tokyo Medical Center, 2-5-1 Higashigaoka, Meguro-ku, Tokyo 152-8902, Japan

N. Yahagi (✉)
Division of Research and Development for Minor Invasive Treatment, Cancer Center, Keio University School of Medicine, Shinjuku-ku, Tokyo, Japan
e-mail: yahagi.keio@gmail.com

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10.2 Prevalence and Carcinoma Risk of Colorectal Neoplasias

Prevalence of lesions and risk of HGIN or cancer are shown for macroscopic types in Table 10.1a and for LSTs in Table 10.1b. The overall prevalence of these lesions compares well with the adenoma detection rate between 15 % (women) and 25 % (men), a *benchmark* for screening colonoscopy [7, 8]. The prevalence of non-protruded neoplasias represents their predicted detection rate (benchmark criteria).

Table 10.1a Prevalence and cancer risk of colonic mucosal neoplasms [3, 5, 6, 8]

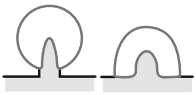
Superficial neoplastic lesion		Prevalence (%)	Cancer risk (%)	Recommended resection
Polypoid 0-Ip/Isp/Is		~15–20	1–15	Snaring
Elevated/flat 0-IIa/b		~5	4–6	EMR
Depressed 0-IIc		~0.5	*30–75*	→ *En bloc*

Table 10.1b Prevalence and cancer risk of lateral spreading tumors [5, 9, 10]

Superficial neoplastic lesion		Prevalence	Cancer risk	Recommended resection
LST-G(H; homogenous)		~5	0–1.5	EMR
LST-G(M; mixed nodular)		~5	*13(−30[a])*	→ *En bloc*
LST-NG(F, flat)		~3	*>10(−29[a])*	→ *En bloc*
LST-NG(PD, pseudodepressed)		~1.5	*28– ~70*	→ *En bloc*

[a]For large size (>30 mm)

10.3 Basic Structure of Colonic Mucosa and Colorectal Neoplasias

Colorectal mucosa is covered with cylindrical cell epithelium containing absorptive colonocytes and mucin-producing goblet cells. On standard WLI, normal colorectal mucosa shows smooth surface reflex (of mucin layer) and mildly reddish color with branching (dendritic) submucosal vascular pattern of collecting venules (Fig. 10.1a, b). Colonic mucosal glands are tubular structures and the pitlike gland openings form a regular carpet of small round pits – named normal *PP type I* [5] (Fig. 10.2a). Inflammation causes mucosal edema and vascular erythema of mucosal and sm layer, diminished surface reflex (by inhomogenous mucin layer), and epithelial erosions with whitish fibrin exudates or even mucosal ulcers (Fig. 10.5, see below). Permeation of dendritic sm vascular pattern is diminished or absent, but surface shows normal round pits type I or, when chronic, regenerative hyperplasia with stellar pit pattern type II (Fig. 10.2b).

Image-enhanced magnification endoscopy (*IEE*) with magnifying NBI and/or chromoendoscopy is used for analysis of early mucosal neoplasias. S. *Kudo* has first characterized magnified chromoendoscopic surface structure of glands (*pit pattern*) in normal mucosa and hyperplastic and neoplastic mucosal lesion in the colon (Table 10.2b), and *Y. Sano* using magnifying NBI endoscopy investigated alterations in *capillary pattern* of such lesions as compared to normfal mucosa (Table 10.2a). The Japan Gastroenterological Endoscopy Society has achieved consensus on classifications of *capillary pattern (CP)* and *pit pattern (PP)* [5, 11]. A simplified version of both is the *Narrow-Band Imaging International Colorectal Endoscopic Classification* (*NICE*) for *standard endoscopy* (indigo carmine and NBI) (Table 4.2) [11, 12]. But original CP and PP classification more accurately diagnose sm-invasive cancer.

Colonic Capillary Pattern (CP) (Table 10.2a). CP *type I* appears as scanty, regular reticular network in normal mucosa on M-NBI – reflecting the capillary mesh-

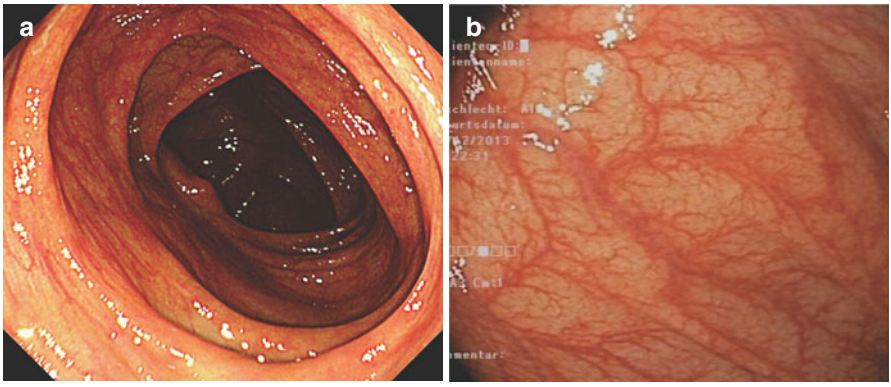


Fig. 10.1 (**a**) Normal ascending colon, WLI, and (**b**) normal ascending colonic mucosa, WLI

work around regular gland grooves. In hyperplastic lesions it is obscured by the hyperplastic marginal crypt epithelium and barely visible. Regularly meshed *CP type II* indicates adenoma, and irregular *CP type IIIA* pattern is seen in intramucosal or superficial submucosal extension of cancer and in rare lesions 0–IIc with undifferentiated adenocarcinoma (<2 % of colorectal carcinoma). CP *type IIIB* is sparse, is very irregular with few thick vessels, and suggests deeply sm2-3 invasive cancer (specificity 85 %) [11, 13, 14].

10.4 Differential Diagnosis of Macroscopic Type of Colorectal Lesions

Mucosal neoplasias (adenoma, HGIN, adenocarcinoma) are lesions with clear *margins* and *disappearance* of *dendritic submucosal vessel* pattern and exhibit *neoplastic pit patterns* (*III–V*) with indigo carmine CE and/or variants of hyperplastic pit pattern (type II; below Fig. 10.15) in case of serrated adenomas (algorithm in Fig. 10.3). Detection of lateral margins of protruding or flat neoplasia is easy in normal colonic mucosa. Lack of clear margin in the presence of hyperplastic pit pattern favors *hyperplastic* (nonneoplastic) polyps (*HP*), most of them in rectosigmoid colon as lesions 0-Is/Isp or 0-IIa (Fig. 10.4a, b). They must not be confused with serrated adenomas that also exhibit hyperplastic pit pattern, often in right colon as lesions 0-Is or 0-IIa (compare Sect. 10.7). In addition, several similar protruding lesions (0-Isp, 0-Is, 0-IIa) exhibit normal mucosal surface and submucosal vascular pattern such as submucosal tumor (*SMT*), rare *hamartoma* (Peutz-Jeghers polyp, juvenile polyp) or

Table 10.2a *Colonic microvascular pattern according to Sano [11] (permission granted by John Wiley & Sons Inc.)

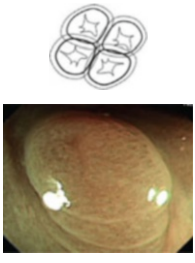
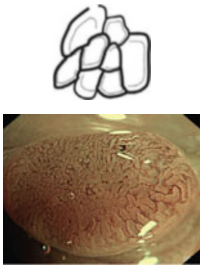
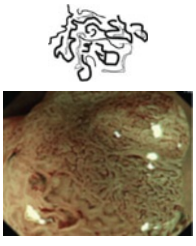
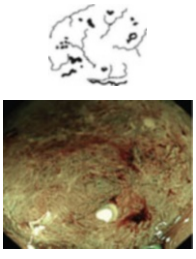
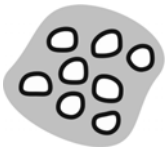
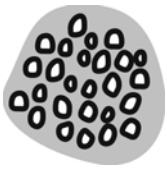
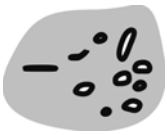
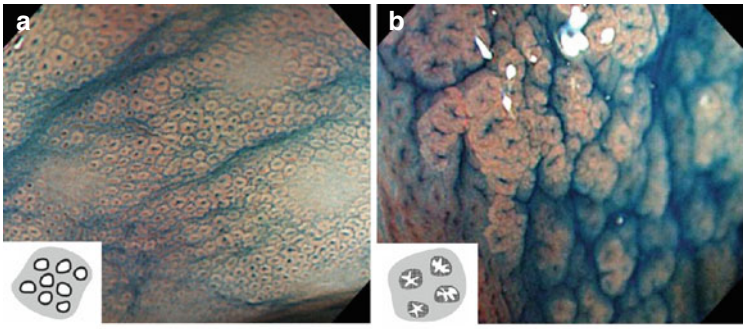
Type I	Type II	Type IIIA	Type IIIB
			
Meshed capillary vessels (−) (faint pattern)	Meshed capillary vessels (+) Vessel surrounds mucosal glands	Meshed capillary vessels characterized by blind ending, branching, curtailed irregularity *Lack of uniformity *High density of capillary vessels	*Nearly avascular or loose capillary vessels

Table 10.2b Pit pattern type of colonic mucosa [15, 16] (compare Fig. 10.2a–g)

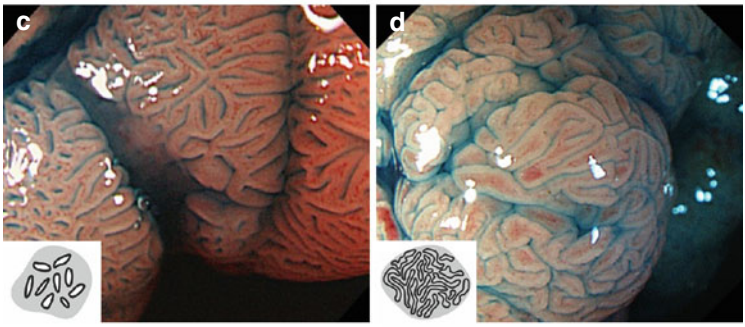
	Type[a]	Description of pits	Histopathological correlates
	I	Round (uniform pits)	Normal or inflammatory mucosa
	II	Stellar or papillary	Hyperplastic mucosa (hyperplastic polyp or serrated adenoma)
	IIIs[b]	Small tubular, round	Adenoma or carcinoma (often depressed type)
	IIIL	Large tubular or round	Adenoma (often classical polypoid adenoma)
	IV[a]	Branching or gyrus-like	Adenoma (often villous)
	V_I low-grade	Irregular pits with smooth margins	Adenoma (LGIN), early cancer (HGIN, T1m, or T1sml)
	V_I high-grade	Irregular, narrow pits With rough margins	sm-invasive cancer (80 % ≥ sm2)
	V_N	Nonstructured	sm-invasive cancer (≥sm2)

[a]Patterns: normal (type I), hyperplastic or serrated (type II), neoplastic (types III–V)
[b]IIIs and V show amorphism (i.e., asymmetrical pits irregular in arrangement and sizes, in part destructed) and are highly predictive of malignancy. Type IIIs adenoma probably is the precursor lesion for flat and depressed superficial cancers and carries a high risk of minute mucosal cancer nests; type V areas (V_i high grade, V_N) indicate a high risk of submucosal invasion [7, 15, 16]



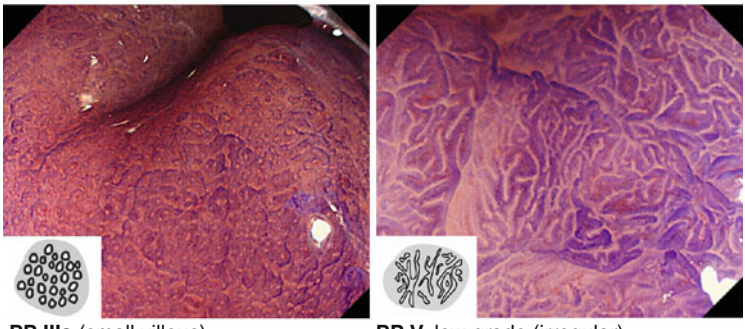
PP I (normal round)

PP II (star-shaped, stellar)



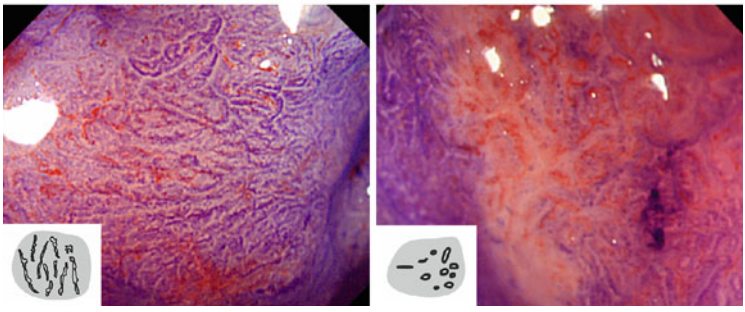
PP IIIL (large villous)

(d) PP IV (branched, gyrous)



PP IIIs (small villous)

PP V_i low-grade (irregular)



PP V_i high-grade (irregular, narrow pits with rough margins)

PP V_N (non-structured, amorphous)

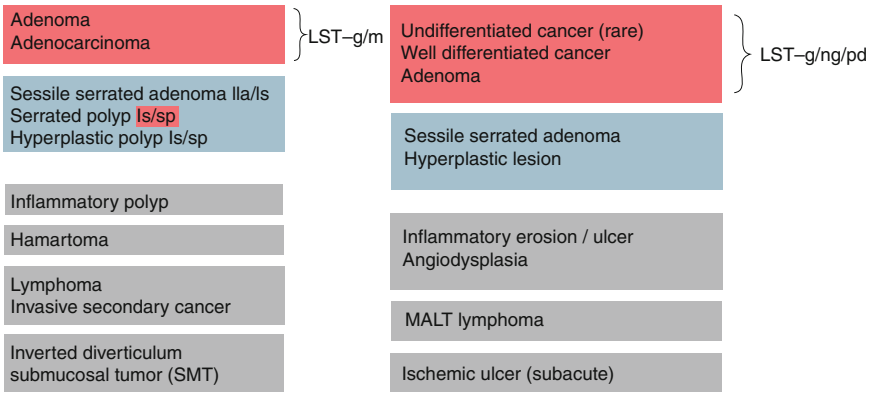


Fig. 10.3 Differential diagnosis of colorectal lesions according to pit pattern on indigo carmine CE: neoplastic (*red*), hyperplastic/serrated (*blue*), and normal pit pattern (*grey*). Mucosal neoplasias (adenomatous, serrated, and cancerous) exhibit distinct sharp margins, in contrast to hyperplastic or inflammatory lesions or diffuse submucosa-infiltrative neoplasias

inverted diverticulum, which is soft and pliable. Reddish or isochrome polypoid or sessile lesions with normal or hyperplastic surface pattern are typical of *inflammatory pseudopolyps* in ulcerative colitis or Crohn's disease (Fig. 10.4c, d; compare Chap. 11), rarely of sm-infiltrating lymphoma or secondary carcinoma originating from other sites or organs (peritoneum, ovary, metastatic cancer).

Flat or depressed lesions (*0-IIa-c*, often reddish) with key neoplastic signs (clear margins, neoplastic pit pattern, and disappearance of dendritic sm vascular pattern) are *mucosal neoplasias*. Reddish hyperemic lesions with uncertain margins comprise inflammatory mucosal lesions, such as erosions and inflammatory ulcer (often with fibrin coating, Fig. 10.5), ischemic ulcer, or angiodysplasia. Pale flat lesions with nearly normal pit pattern are typical for mucosal *MALT lymphoma*, or subacute *ischemic ulcerations* that show pale or mildly red lesions, but differ by bare proper muscle layer in the center surrounded by a margin of regular mucosa (lack of neoplastic pattern) (Fig. 10.6).

Pale flat lesions with disappearance of sm vascular pattern and some unclear margins are also compatible with *LST-nongranular type*, which however shows *clear margins* on magnifying NBI.

Flat and *depressed neoplasias* including *LST-nongranular type* and most *LST-granular type – LST-GH*, *LST-GM*, *and LST-G-whole nodular* – show discolored,

Fig. 10.2 Colonic pit pattern types I–V_n (According to Kudo [5, 16]). Magnified (~40–80-fold) chromoendoscopy (**a**–**e**, indigo carmine; **f**–**g**, crystal violet). Compare Table 10.2b for explanation. (**a**) PP I (normal round). (**b**) PP II (star-shaped, stellar). (**c**) PP IIIL (large villous). (**d**) PP IV (branched, gyrous). (**e**) PP IIIs (small villous). (**f**) PP V_I low grade (irregular). (**g**) PP V_I high grade (irregular, narrow pits with rough margins). (**h**) PP VN (nonstructured, amorphous)

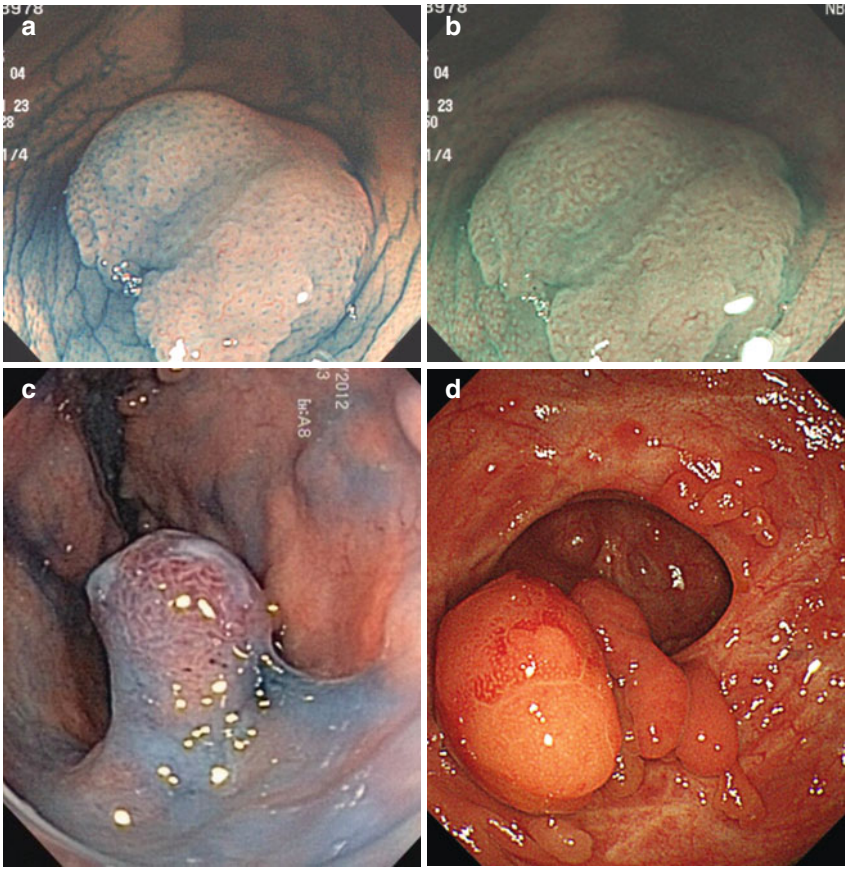


Fig. 10.4 (**a**, **b**) *Sessile hyperplastic polyp*, PP II (stellar) in cecum, (**a**) indigo carmine CE; **b**) CP I (faint mesh) in cecum, M-NBI (40×). (**c**) *Nonneoplastic 0-Ip* (chronic inflammatory-regenerative lesion in moderately active ulcerative colitis), sigmoid colon indigo carmine CE. (**d**) *Nonneoplastic 0-Isp and 0-Is lesion* with unclear margin, in part visible CP I, PP II (inflammatory-regenerative, moderately active Crohn's disease), sigmoid colon, WLI

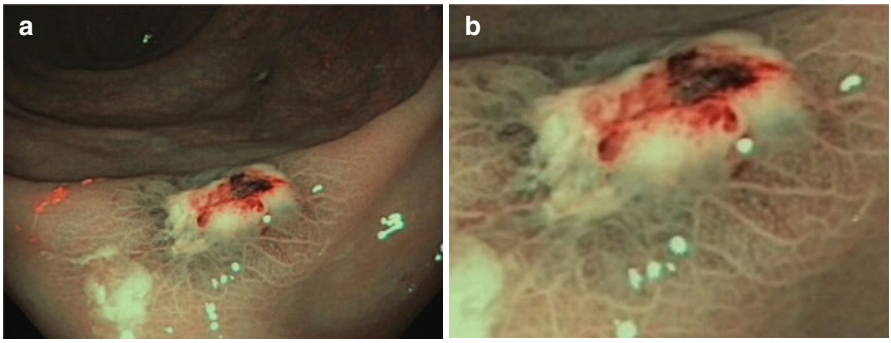


Fig. 10.5 (**a**) Solitary rectal ulcer in an 82-year-old man, standard NBI. (**b**) CP type I (meshed), PP type I, and uncertain margin of fibrin covered ulcer, standard NBI

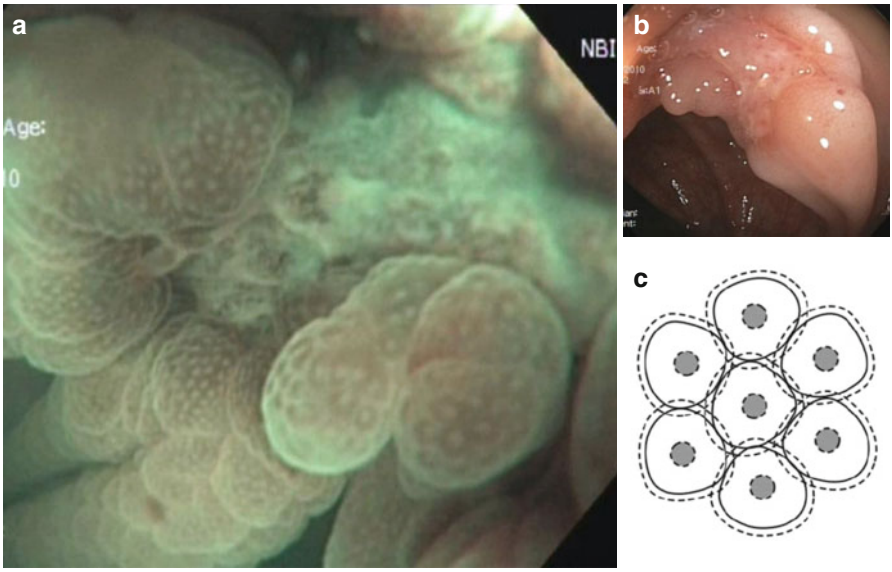


Fig. 10.6 Lesion type 0-III. One of the two ulcers on neighboring haustral folds in the left transverse colon in an 80-year-old woman. (**a**) Standard WLI aspect. (**b**) Typical *subacute ischemic ulcer* with bare ground (proper muscle) and mucosal margins showing normal CP (meshed, CP I) and normal pit pattern (white dots, PP type I); M-NBI 80x. (**c**) Schematic of PP type I and CP type I (Modified from Sano et al. [17])

often pale, areas with clear margins and disappearance of normal sm vascular pattern (Fig. 10.7a–j). They are further distinguished in *classical adenoma*, *serrated adenomas* or *HNPCC-associated adenoma*, and *HGIN/intramucosal carcinoma* (see IEE analysis, below). Depressed neoplasias type 0-IIc display *air-induced deformation* when infiltrating muscularis mucosae (MM) or superficial third of submucosa layer (sml) (Fig. 4.2b; compare below Sect. 10.6). Early cancer with invasion into sml often presents mild (0-IIc) or marked (IIc + IIa) surface depression (Table 4.2C).

Most *LST-NG* show normal color and *relatively ill-defined margins*; therefore, only larger size LST-NG are easily apparent on WLI endoscopy. Indigo carmine enhancement demonstrates distinct margins of the lesion (Fig. 10.7h, j). Prevalence of LST is highest in right colon as well as in rectum. Risk of focal cancer in different type LST is detailed in Table 10.3. The probability of *malignant transformation of LST* increases with *size* of the lesion, especially when >30 mm, and *type*, being very high in *LST-GM*, *LST-NG*, and highest in pseudodepressed *LST-NGPD* (Fig. 10.7i, j).

Retrospective analysis (period 1998–2006) of LSTs (≥20 mm size) resected at the National Cancer Center, Tokyo, confirmed sm-invasive cancer in 0.9 % of LST-GH, 16 % of LST-GM, and 58 % of LST-NG but only in 5 % of small size (d < 20 mm) LST-GM or LST-NG. Hence, NCC recommends resection en bloc for LST-NG of size ≥20 mm and LST-GM ≥40 mm [18].

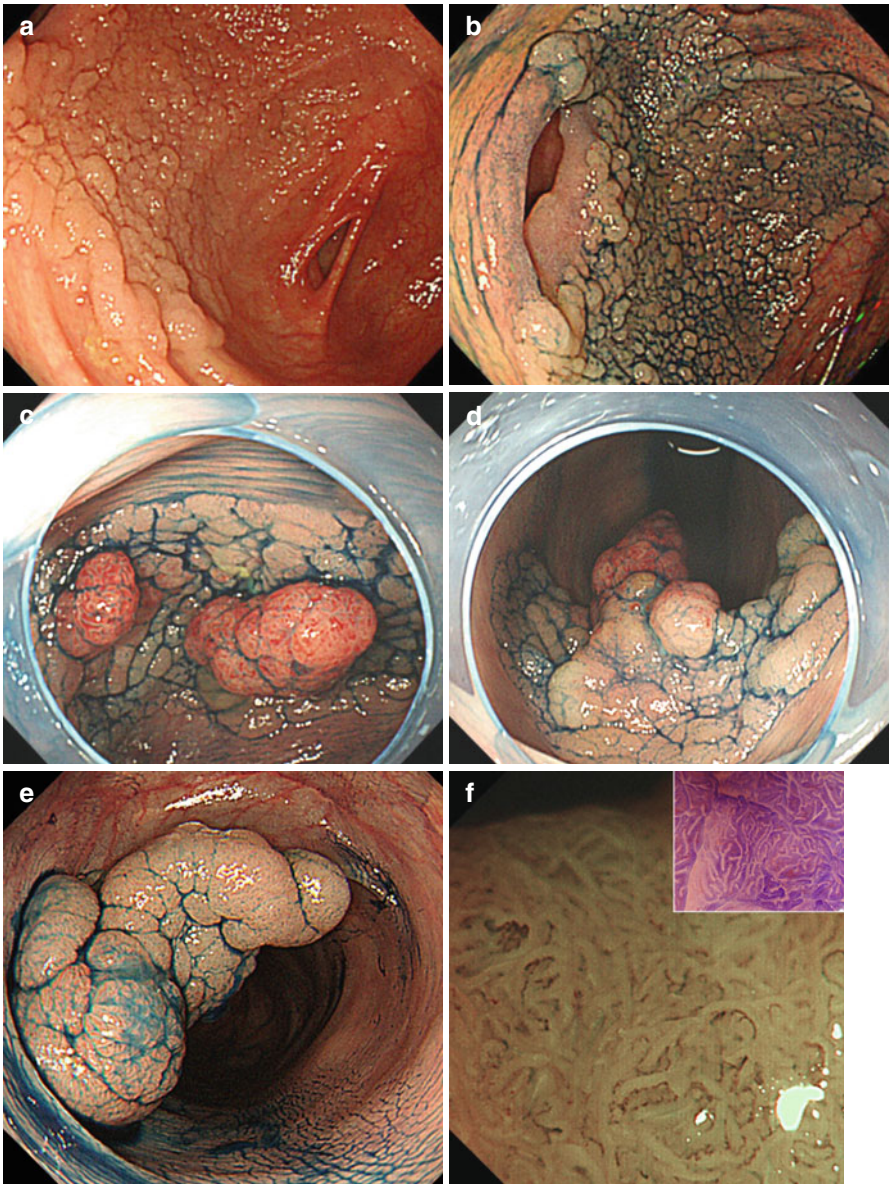


Fig. 10.7 *LST-G*. (**a**, **b**) LST-G granular homogenous type, cecum, (**a**) WLI; (**b**) indigo carmine CE. (**c**, **d**) LST-GM granular mixed nodular type, (**c**) WLI; (**d**) indigo carmine CE. (**e**) LST-G whole nodular. 0-Is + IIa, 30 mm in diameter, transverse colon, indigo carmine CE. (**f**) Same LST-GM as in (e) on M-NBI (80×): CP IIIA (insert with crystal violet CE: PP type V_I low grade). ESD: tubular adenocarcinoma (intramucosal)

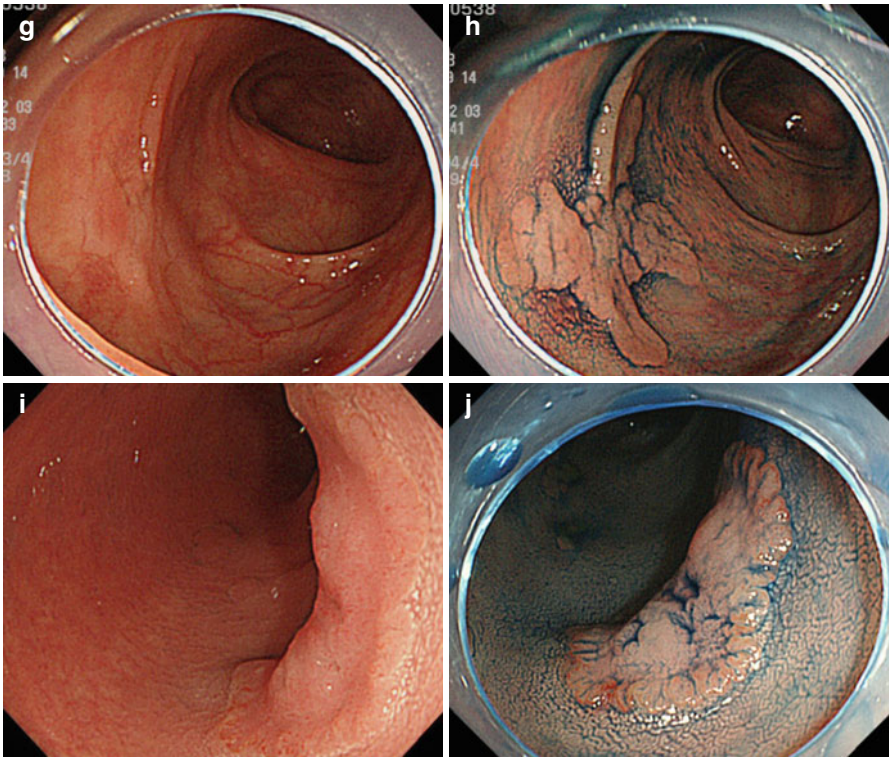


Fig. 10.7 (continued) *LST-NG*. **(g, h)** LST-NG flat (0-IIa); WLI and indigo carmine; **(i, j)** LST-NGPD (0-IIa + IIc, central protrusion), WLI and indigo carmine CE

Table 10.3 Characteristics of LST and lesion 0-IIc (and IIa + c) treated with ESD [9]

		Mean		Percentage of lesion type			
	Lesion	n	Size [mm]	LGIN (%)	HGIN (%)	Ca ≤sml (%)	Ca ≥sm2[a] (%)
	LST-G(H)	57	32	32	*26*	*42*	0
	LST-G(M)	86	39	9	*30*	*56*	5
	LST-NG(F)	77	22	26	*34*	*36*	3
	LST-NG(PD)	25	20	16	*12*	*68*	4
	IIc and IIa + IIc	6	17	0	0	*33*	*67*

[a]All lesions were chosen suitable for ESD (leading to selection bias, because LST with endoscopic criteria of massively sm-invasive cancer had a priori been excluded). Note the high percentage of HGIN/mucosal cancer in larger size LST

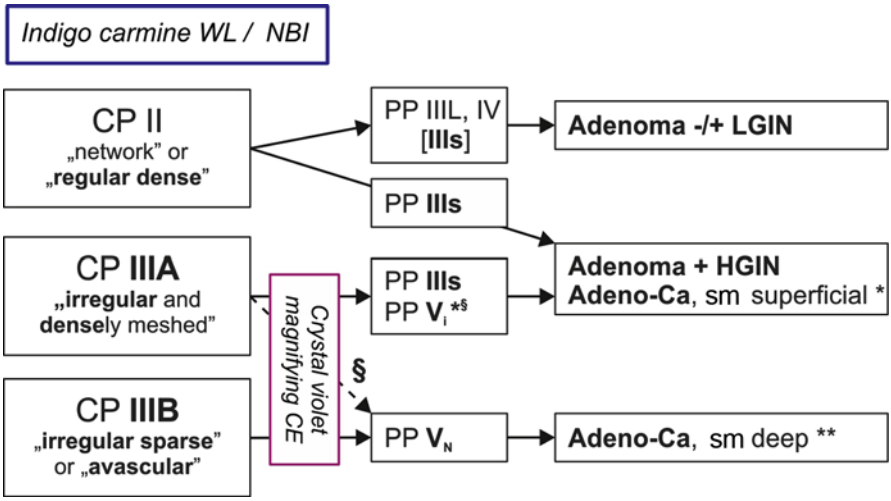


Fig. 10.8 *Analysis of colorectal mucosal neoplasias* with magnifying NBI/chromoendoscopy, to distinguish malignancy and grade of invasiveness by capillary pattern (*CP*) and pit pattern (*PP*). §PP type V_I high grade with encroachment of margins signals deep sm invasion. *superficial sm invasion <1,000 μm; **deep sm invasion ≥1,000 μm

10.5 Differential Diagnosis of Colorectal Lesions Using Magnifying Image-Enhanced Endoscopy

Image-enhanced magnification endoscopy (*IEE*) using NBI for (CP) indigo carmine for PP II-IV and crystal violet CE for PP V is basic for accurate (>90 %) endoscopic differential diagnosis of early mucosal neoplasias, in order to predict histologic type of neoplasia and tumor category (algorithm see Fig. 10.8). First, CP is diagnosed on M-NBI, then decision on indigo carmine or crystal violet CE is made for diagnosis of PP.

Note

IEE with magnification (≥60×), NBI, and often crystal violet CE is required to accurately (>90 %) differentiate by CP and PP:

- Adenoma *versus* carcinoma
- Intramucosal *versus* submucosa deeply invasive carcinoma
- Hyperplastic lesion *versus* adenoma and serrated neoplasias (the latter distinction is *less* accurate; compare Sect. 10.6)

Hyperplastic lesions type 0-I or IIa are mainly hyperplastic polyps (*HP*) and are frequently seen in rectosigmoid colon (Fig. 10.4). Sporadic hyperplastic polyps are nonneoplastic displaying stellar PP type II (Fig. 10.2b) and scanty, regular CP type I (Table 10.2a; Fig. 10.4).

Adenomas consist of transformed colonocytes with enhanced nucleus/cytoplasm ratio, loss of polar orientation of cell nuclei in the epithelial layer, enhanced clonal proliferation of colonocytes, and formation of pseudoglandular structures (compare

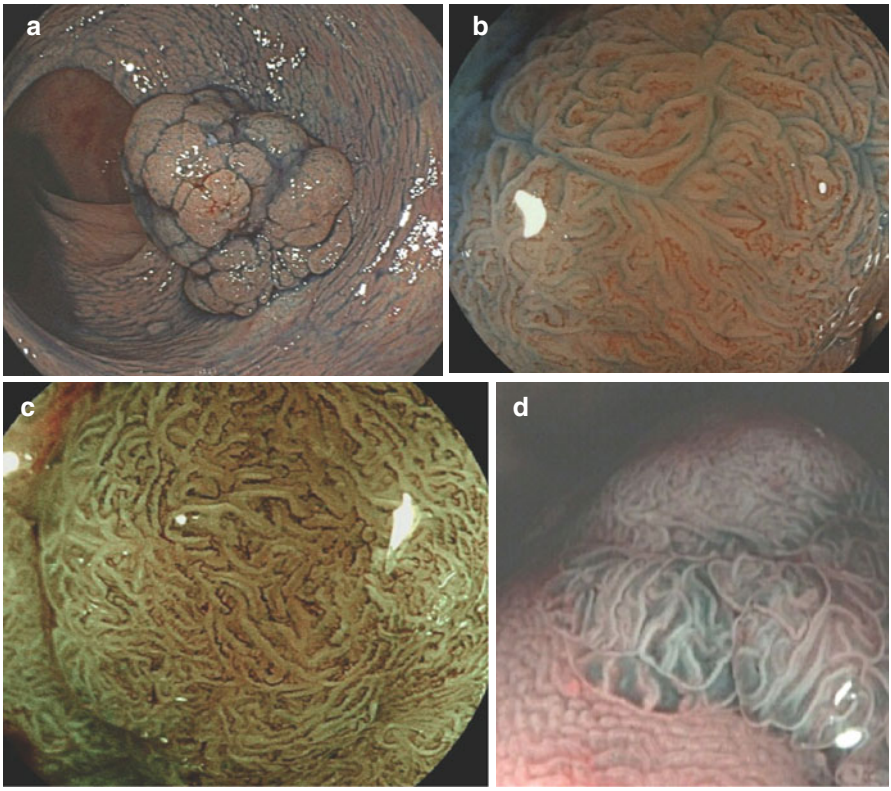


Fig 10.9 (**a**–**d**) *Protruding neoplasia 0-Isp*, 25 mm in diameter, (**b**) WLI indigo carmine CE (**c**) with magnification, (**d**) M-NBI (80-fold): PP type IV and CP type II. Histology: *tubulovillous adenoma* with focal HGIN. (**d**) *Protruding adenoma 0-Isp*, 15 mm in size, clear margin without demarcation of relief, CP type II (and PP type IIIL), even surface pattern (*SP* marginal crypt epithelium; M-NBI 60-fold). EMR *tubular adenoma* with LGIN

Fig. 4.6). By definition, adenomas lack invasive or metastatic potential, and the process of cell-cell adhesion is preserved. Therefore, the lesion forms single layered, glandular marginal epithelium, seen as *surface pattern* (*SP*) using NBI with magnification (Fig. 4.5). The enhanced proliferation of pseudoglandular structures creates patterns of different surface shapes. Adenomas typically show regular pseudoglandular structure, visualized as *PP* type *IIIl* or *IV,* rarely *IIIs* or *Viregular* (Fig. 10.2c–g), and dense *CP* type *II* (Figs. 10.9 and 10.10). The margin of adenoma is clearly visible on WLI (and NBI) by change of type in surface pattern but without demarcation of surface relief (Fig. 10.9d, compare Fig. 4.6). The regular structure of adenomatous epithelium is well visualized by absorptive staining of colonocytes using *crystal violet*. Crystal violet best demonstrates irregular or destroyed pseudoglandular structure (*PP* V_I *or* V_N) (Fig. 10.2f–h).

Note

Adenoma shows typical structural findings on WLI and indigo carmine:

- *Disappearance of submucosal vascular pattern*
- *Clear lateral margins of the lesion*
- *Reddish in color, lobulation on the lesion surface*
- *Regular pit pattern,* tubular (*III*l sometimes *IIIs*) or branched (*IV*)
- *Even distension* of type 0-IIa + IIc adenomas on insufflation/desufflation, and

Typical structural findings on magnifying NBI:

- *Even surface pattern* (marginal crypt epithelium)
- *Regular network* microvascular pattern (*CP type II*)

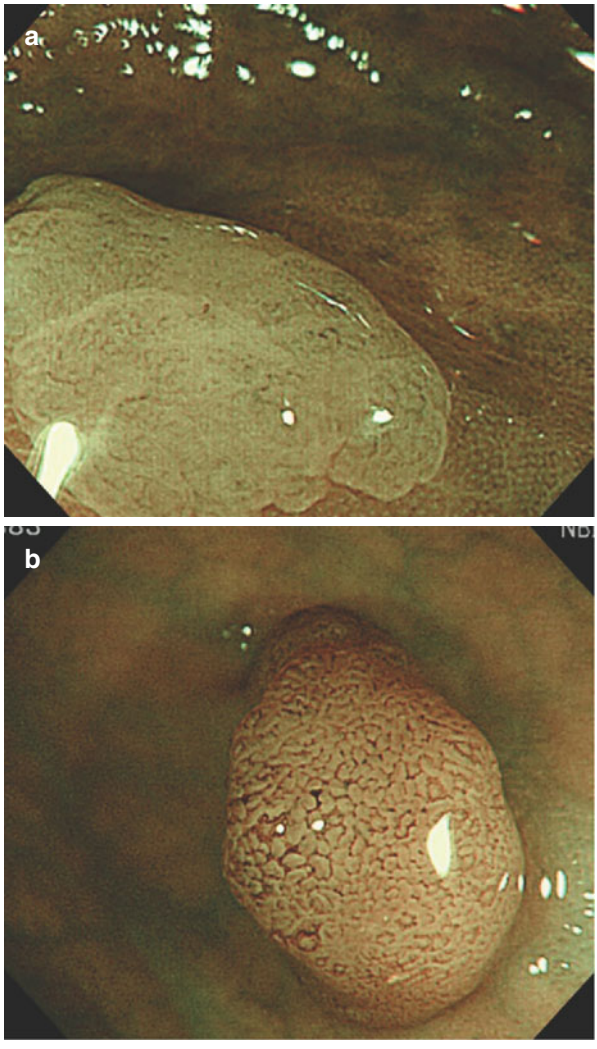


Fig. 10.10 Capillary pattern (CP) types (M-NBI, 100×). (**a**) *CP type I* meshed is faintly visible (–) in hyperplastic lesion type IIa (with PP type II), as compared to CP type I (+), visible in adjacent normal mucosa (*right side*). (**b**) *CP type II*, regularly meshed, in lesion 0-Is is typical for adenoma (probable PP IIIL)

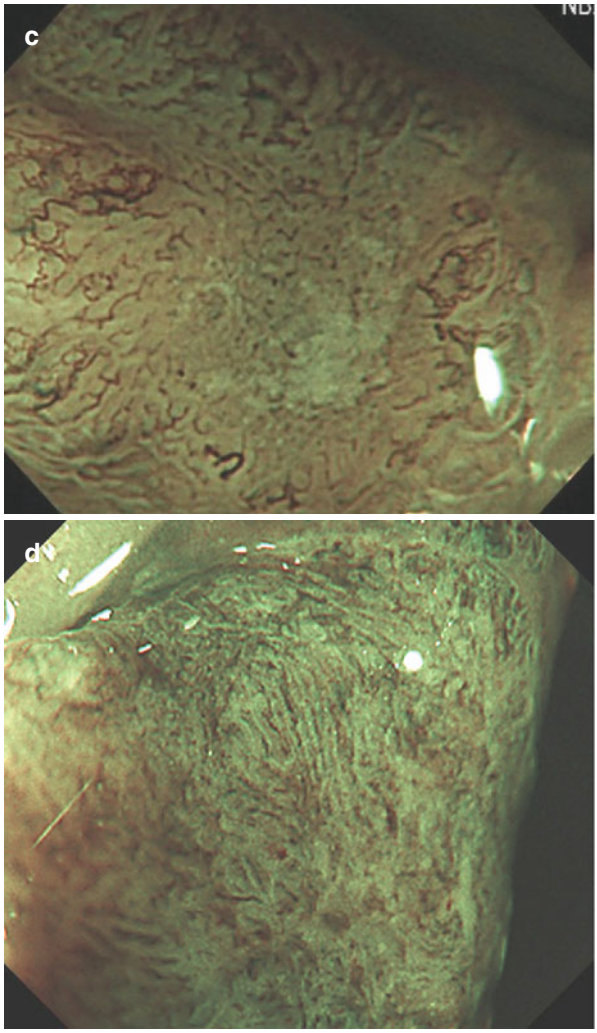


Fig. 10.10 (continued) (**c**) *CP type IIIA*, irregularly meshed, dense capillary pattern, in flat lesion compatible with adenoma and HGIN or intramucosal (or superficially sm-invasive) differentiated cancer. Crystal violet CE is recommended for evaluation of pit pattern. (**d**) *CP type IIIB*, loosely irregular, and in part sparse capillary vessels suggesting sm-invasive early cancer (≥sm2). Crystal violet CE is required to categorize the corresponding pit pattern type V (e.g., high-grade irregular or nonstructured)

Differentiated adenocarcinoma (G1, G2) exhibits irregularities in thickness and shape of cancerous marginal crypt cell layers (*irregular SP*) and irregular pseudogland structure (*irregular pit pattern PP type* V_I or V_N on crystal violet CE) (Figs. 10.8 and 10.2f–h, compare Sect. 10.9, case no. 1). Angiogenesis created irregular dense capillary pattern *CP* type *IIIA* [10, 12, 19, 20] (Figs. 4.4b, 10.7f and 10.10c). Coherently growing cancer cell clusters exhibit sharp margins with "*demarcation line*" *of surface relief* toward surrounding adenomatous or normal epithelium. *Deep sm-invasive cancer* destroys, at least in part, pseudogland structure and microcapillaries and creates destructive, amorphous pit pattern (*PP* V_I *high grade*, V_N) and irregular, sparse microvessels with varying thick caliber (*CP type IIIB*) (Figs. 10.2g–h and 10.10d).

Undifferentiated carcinoma (G3) is very rare (<5 %) in colorectum, and endoscopic distinction from differentiated cancer is not yet evidence based.

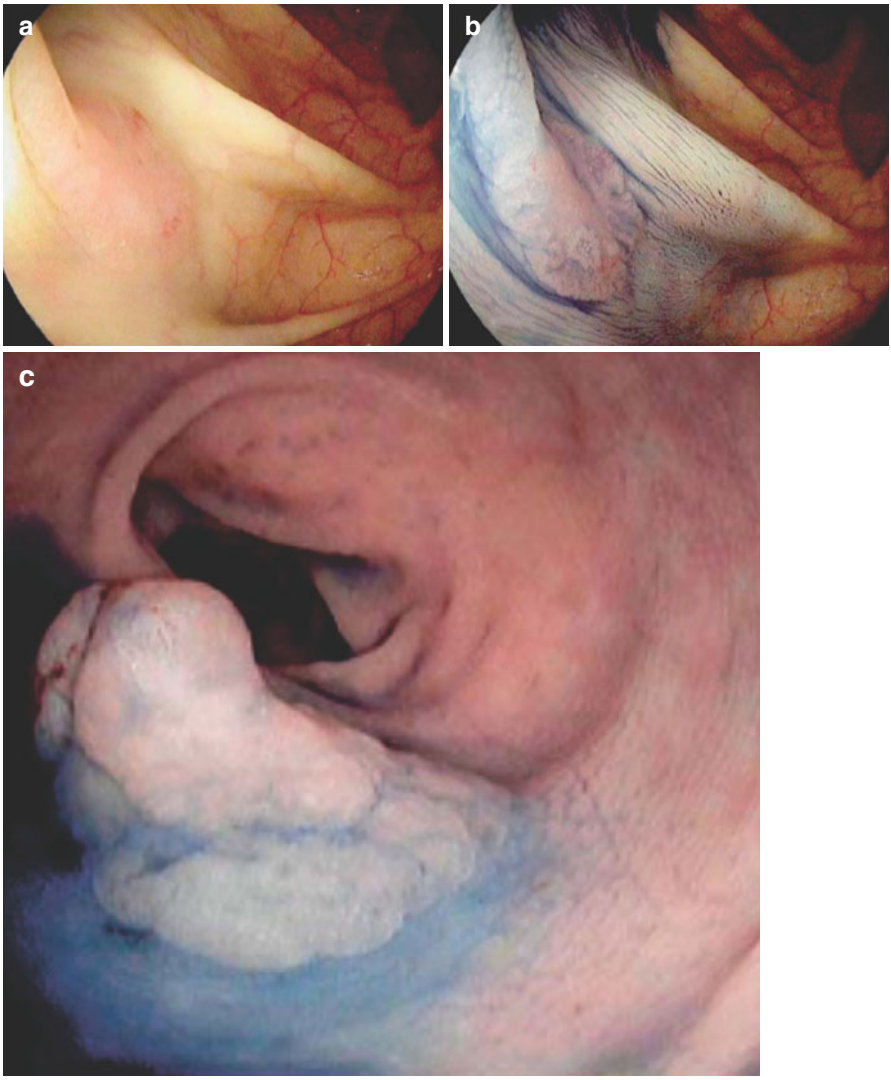


Fig. 10.11 (**a**) LST-NG (0-IIa) isochrome, ascending colon, in a 41-year-old man, HNPCC (MLH-1 mutation). (**b**) Indigo carmine: enhanced margins of the neoplasia. (**c**) LST-GM (0-Is + IIa), isochrome, 15 mm, in a 32-year-old woman, HNPCC (MLH-1 neg.), detected at surveillance 24 months after negative colonoscopy, indigo carmine. (Pan-)chromoendoscopy enhances detection of flat neoplasias in HNPCC ([21] Permission from Thieme [Endoscopy])

Key Points

Hallmarks of early differentiated adenocarcinoma (AC G1 or G2):

- *Irregular SP* (uneven thickness of cancerous epithelium)
- *Irregular pit pattern* PP V_I (or *amorphous PP* V_N)
- *Irregular CP* type IIIA or IIIB
- *Demarcation* of relief at lateral margin of cancer within an adenoma

Flat HNPCC neoplasias in hereditary non-polyposis coli syndrome (Fig. 10.11a–c) show distinctive 0-IIa/b/c type lesions, mainly *pale* with *clear*

margins after indigo carmine enhancement or on magnifying NBI. The overall number of lesions in the colon is *not* significantly increased in HNPCC as compared with sporadic adenoma carriers, but *flat adenomas with pale components* (70–80 % mucinous villous) and *CRC* occur at an earlier age (mean age 35–40 years) and predominantly (~70 %) in the *right hemicolon* [21]. A high proportion (*40–80 %*) contains *HGIN or carcinoma*, mainly with mucinous differentiation [21–23]. M-NBI shows CP II or IIIA and PP IIIL, IV, or V_I/V_N.

10.6 Endoscopic Evaluation of Degree of Vertical Invasion: *Superficial* (M, sm1) Versus *Deep* Invasion (sm2-3)

The estimated *vertical depth of invasion* guides the decision for or against endoscopic resection of early cancer. Other factors raising the probability of metastasis, e.g., lymphatic or vascular invasion, are not predictable on endoscopic signs of early cancer. You must exclude poorly differentiated cancer G3 with targeted biopsy (prevalence <3 % in CRC). Three clues indicate deep sm invasion (≥sm2) of early colorectal cancer:

- *Shape and rigidity* of neoplastic lesion and folds
- *Highly irregular/amorphous PP* and *CP*
- *Poor lifting/non-lifting* of neoplasia upon submucosal injection

Protruded-type early colon cancer is highly suspicious for *sm2-3 invasion* in the presence of small thick pedicle (*fullness of stalk*) or small nodule on top of polypoid neoplasia, friability and color change (and amorphism) or ulceration, fixed deformation of protruding neoplasia upon insufflation/desufflation of colon with air (Figs. 4.2b, 10.12, and 10.13e–f), and irregular *sparse CP IIIB* and *PP* V_N, because sm-invasive cancer destroys carcinomatous pseudoglands and sm layer. Typical images are shown in Fig. 10.13e, f and 10.14f.

Note
Deep submucosal invasion of protuberant (0-Ip, 0-Is) or elevated (0-IIa) early cancer may be signaled by [1, 6, 13, 24–27]:

- Macroscopic signs:
  - Small nodule on polyp (“Buddha-like” polyp)
  - Color change (with amorphism) or bleeding lesion
  - Short thick pedicle or fold irregularity
  - Central depression or ulcer with PP V_N
- Typical changes in PP (to type $V_{I\,high\text{-}grade}$, V_N) and CP (to type IIIB)
- Non-lifting upon sm injection of the lesion (Figs. 10.12a–c and 10.15)

Shape of neoplastic lesion in response to insufflation/desufflation of air into colon informs about critical *vertical invasion* of *flat-type early colorectal cancer*:

- *Air-induced deformation (AID)* of type 0-II cancer lesion indicates tumor invasion in M or sml layer (Fig. 10.13a–c).
- *Fixed deformity* of cancer lesion proofs deep sm≥2 invasion of cancer, e.g., constant swollen convergence of folds−/+fusion (Fig. 10.13d, e).

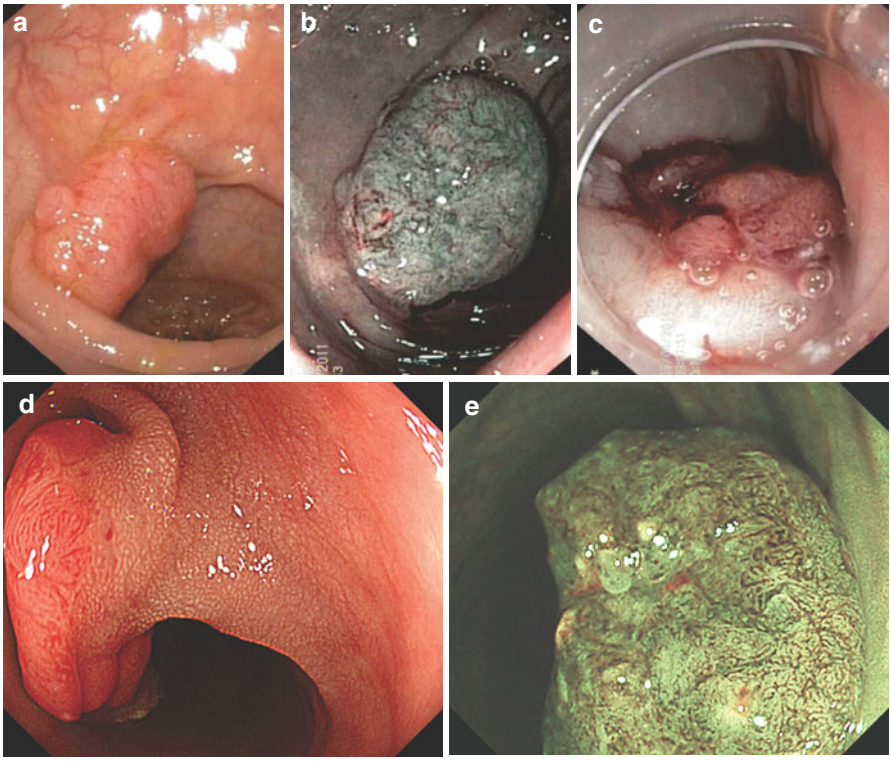


Fig. 10.12 (**a**, **b**) *Nodular neoplasia type 0-Is* with aboral pseudodepression (0-Is+c), friability, and CP IIIB. (**c**) *Complete non-lifting* on sm injection (3×3 ml), descending colon. Laparoscopic resection disclosed tubulovillous adenoma and f*ocal adenocarcinoma G2, sm3*. (**d**, **e**) *Polypoid lesion type 0-Ip* (short pedestal with "fullness of stalk", *left panel*) and *CP type IIIB* (and PP V_i high grade, M-NBI, *right panel*) in sigmoid colon. Histology: well-differentiated *adenocarcinoma (G2)*, *sm2*, and lymphovascular invasion (−)

Note

Signs of sm≥2 invasion (accuracy >90 %) *in flat-type early cancer*:

- Macroscopic signs (Fig. 10.13d, e and 10.14e, f) such as:
  - Expansive protrusion or nodule in depression 0-IIc (Fig. 10.14b)
  - Sparse CP IIIB and PP $V_{I\ high\text{-}grade}$ or V_N (Fig. 10.2g, h)
  - *Non-lifting sign* positive (Fig. 10.12c)

Predilection sites of sm-invasive carcinomatous foci in LSTs have been analyzed in a series of 511 large, en bloc resected LSTs of different subtypes [10] (Fig. 10.16). Such predilection sites must be assessed for signs of invasive cancer, e.g., bleeding sites, sclerous wall change (AID), irregular or sparse CP IIIA/B, and amorphous PP type V_N. Large nodules (>10 mm) in LST-granular mixed types most likely harbor mucosal or even sm-invasive carcinomatous foci and so do depressed areas in homogenous LST-GH or LST-GM. Multifocal sm-invasive cancer foci in LST-NG are hardly predictable on endoscopy; the lesion requires resection en bloc.

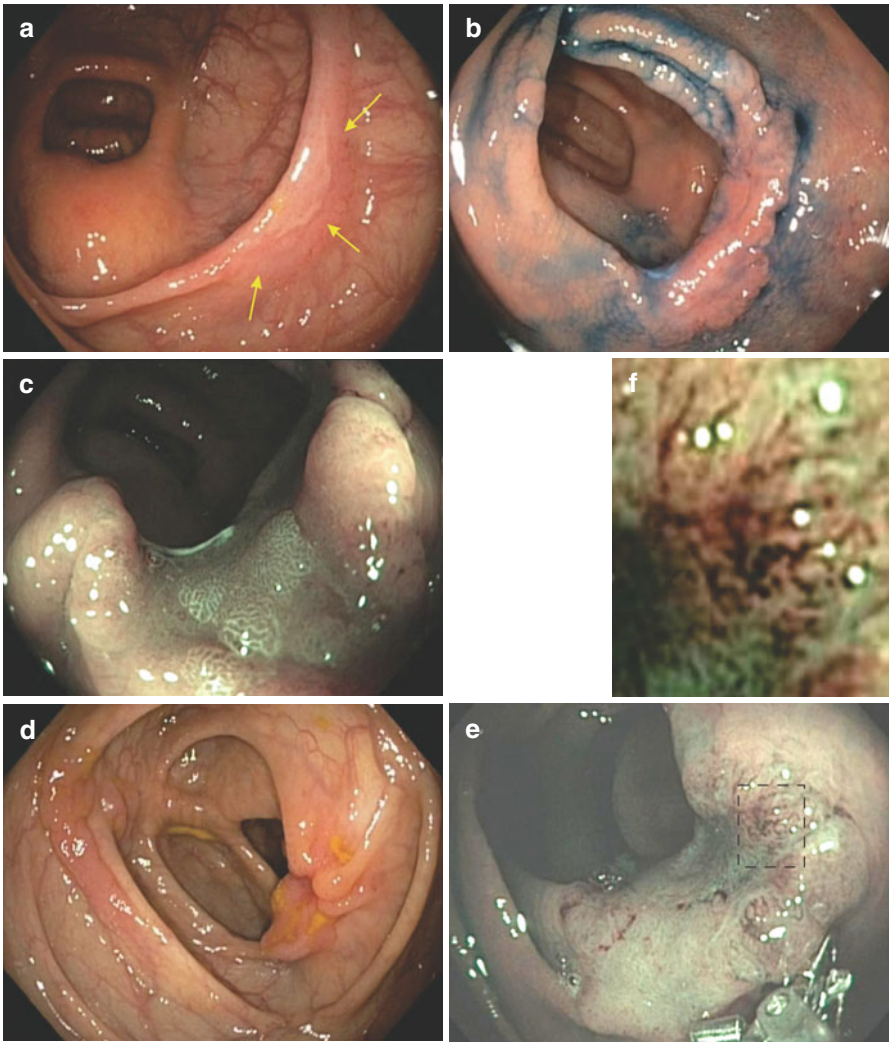


Fig. 10.13 (**a–c**) LST NGPD (0-IIa+c) in ascending colon with *marked AID* (air-induced deformation): (**a**) insufflation with adherent mucus (with adherent mucus), *yellow arrows* mark margin of lesion, (**c**) desufflation (cleaned), (**b**) indigo carmine. (**d**, **e**) Neoplasia 0-IIc+IIa with *fixed shape* and folds during insufflation/desufflation, PP V_I and MCP IIIA, transverse colon, WLI, (**f**) CP IIIB, NBI 80×. Hemicolectomy: adenocarcinoma G2 (mucoid differentiated), pT1b (sm3), Ly0, V0, N0 (0/9), and sm fibrosis

Note

Deep submucosal invasion of early cancer is predictable in:

- Lateral spreading tumors (LST, Fig. 10.16) by:
  - Large nodule >10 mm in LST-G(M) with PP V_N
  - LST-G of whole large-nodular type
  - LST-G >30 mm size with pit pattern V_I or V_N

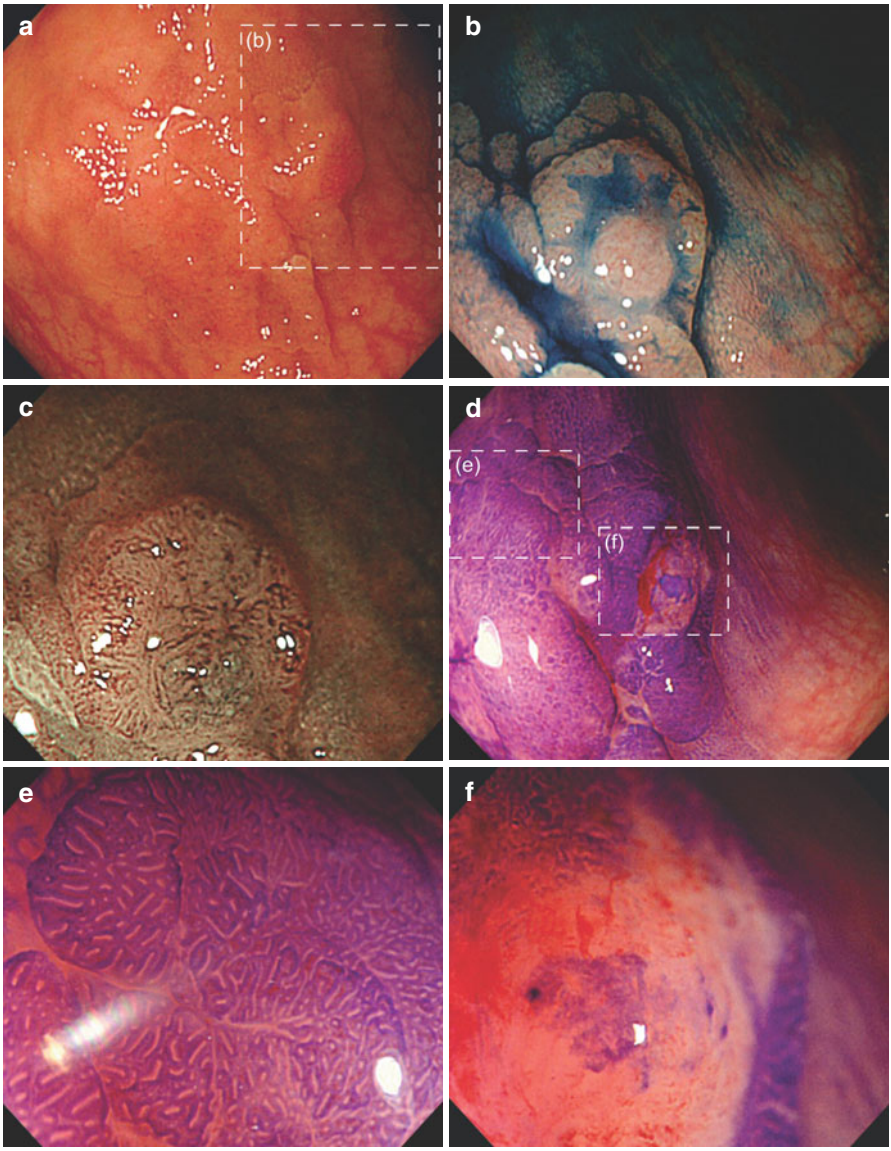


Fig. 10.14 Early CRC 0-IIa+IIc (>sm2 invasive), in sigmoid colon of a 59-year-old man. (**a**) lesion on WLI; (**b**) right margin of lesion with protuberance in depression, indigo carmine; (**c**) protuberance on NBI (CP III in center); (**d**) crystal violet (**e**) insert (e) magnified (80×), PP IIIL; (**f**) insert (f) magnified (80×), tiny area of amorphous PP V_n. ESD using dual knife → adenocarcinoma G1, psm1 (990 µm), 29 × 20 mm, ly0 v0; curative R0

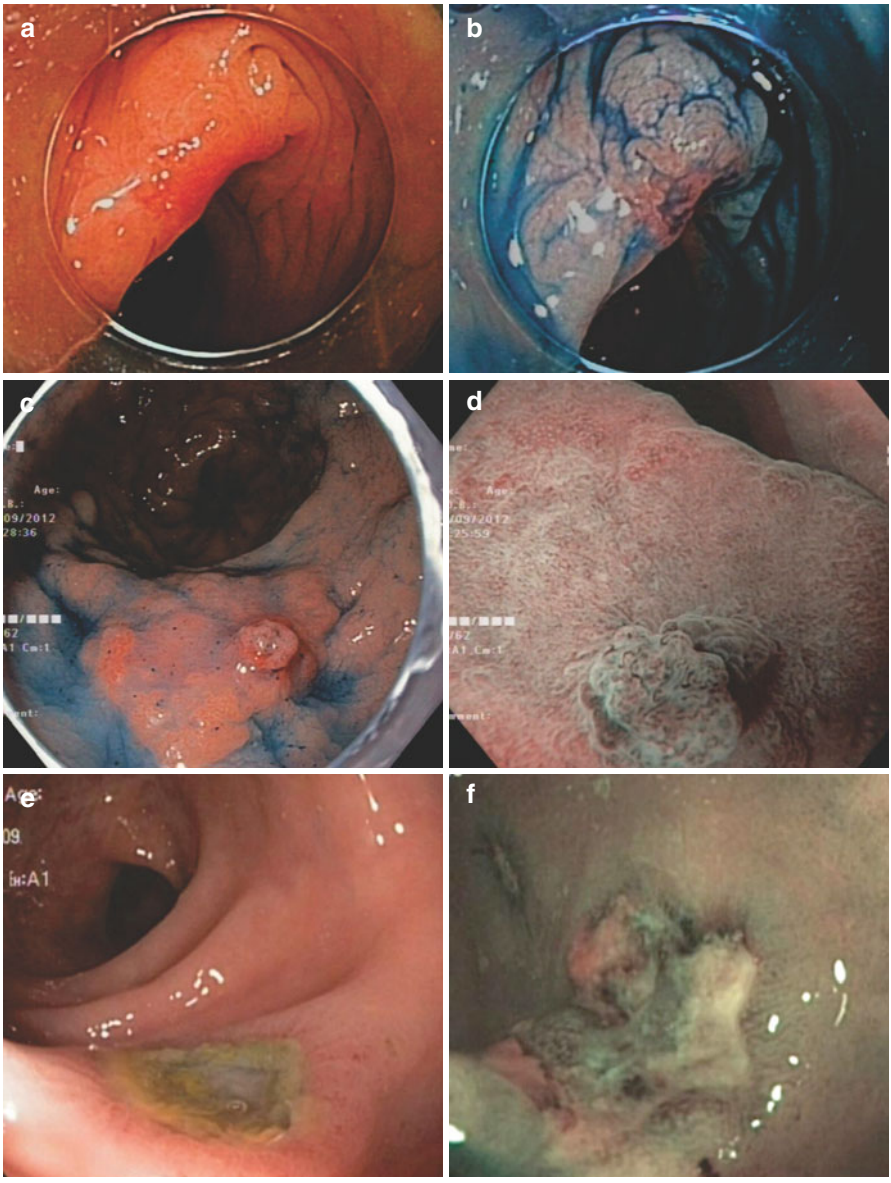


Fig. 10.15 (**a**, **b**) Early cancer 0-IIa+c, with *constant folds and fusion of folds*, transverse colon. Laparoscopic hemicolectomy: adenocarcinoma G2, pTis (M), N0 (0/20), ly0, v0; R0. (**c**, **d**) LST-NG (0-IIb, CP type II, PP type IIIs) with polyp (*0-Isp, CP IIIA, PP* V_I). ESD: adenocarcinoma G2, pTis (M) and tubular adenoma with LGIN and HGIN. (**e**, **f**) *Lesion 0-III*, transverse colon, 18 mm (CP IIIB, PP V_N), *advanced adenocarcinoma* G2, *pT2*

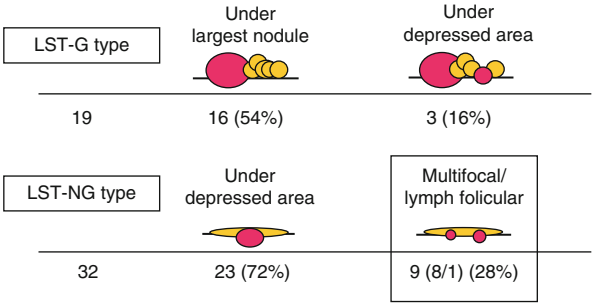


Fig. 10.16 Predilection site (*red nodule*) of *sm-invasive* carcinomatous foci in different types of LST (*yellow*, indicates probably non-invasive parts) (Adapted from Uraoka et al. [10], permission granted by John Wiley & Sons Inc)

  - LST-G with depressed area IIc + IIa and PP V_N
  - LST-NG(PD) >20 mm size with PP V_N
  - Protrusion or ulcer in LST-NG
- Non-lifting upon sm injection of any of the above lesions

10.7 Tentative Distinction of Hyperplastic Versus Serrated Lesions

Combined analysis (Fig. 10.17) of capillary pattern (CP I versus II) with magnifying NBI and surface pattern for PP II-O (Fig. 10.18) and admixed adenomatous pit pattern using crystal violet magnifying CE may distinguish polypoid serrated adenoma (*TSA*, reddish) (Fig. 10.19a, b) and mixed serrated adenoma (*MSA*) (Fig. 10.19c–f) from sessile serrated adenoma (*SSA*, pale, PP II-O) (Fig. 10.20c, d) and hyperplastic polyp (*HP*) (Figs. 10.4 and 10.22a, b). This analysis is not yet validated by prospective studies. Focal *serrated adenocarcinoma, SAC*, is identified in this analysis by areas of irregular or amorphous pit pattern (PP V_i or V_n) and *irregular CP* IIIA/IIIB.

Serrated adenomas (*SA*) consist of hamartomatous "hyperplastic" tissue mixed with adenomatous epithelium and goblet cells and are precursors for mucinous adenocarcinoma (serrated adenocarcinoma, SAC). SA present the following morphology.

Polypoid (traditional) serrated adenomas, *TSA*, are often reddish due to adenomatous parts with PP type III or IV (Fig. 10.19a, b). TSA show a mixed pattern (Fig. 10.18, upper row) alternating with areas of stellar pits type II (nonneoplastic) and neoplastic pits *PP type II-O* and *type IV*, some with distinct variant, *pineal cone-like PP* IV_{SA} [28–30] (Fig. 10.19a, e, f).

Sessile serrated adenomas (*SSA*) (Fig. 10.20e, f), without or with dysplasia, present types 0-IIa more often than 0-Is, occur mainly in the right colon, and have high carcinogenic potential with rapid malignant transformation [20, 28–31]. They are often covered with mucus. "Sticky" adherent mucus requires tenacious flushing with water jet to clean mucosal surface; it tends to cover mucosal pathology such as

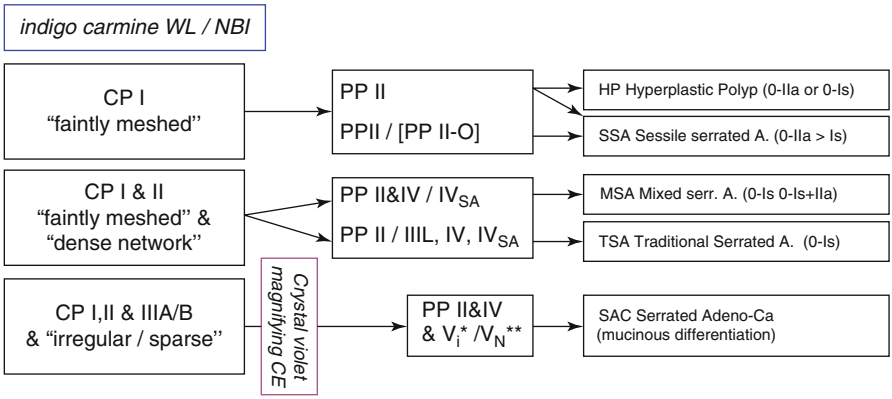


Fig. 10.17 Endoscopic diagnosis of hyperplastic/serrated lesions. Distinction of hyperplastic lesion versus serrated adenoma by capillary (CP) and pit pattern (PP). *superficial sm invasion <1,000 μm; **deep sm invasion ≥1,000 μm

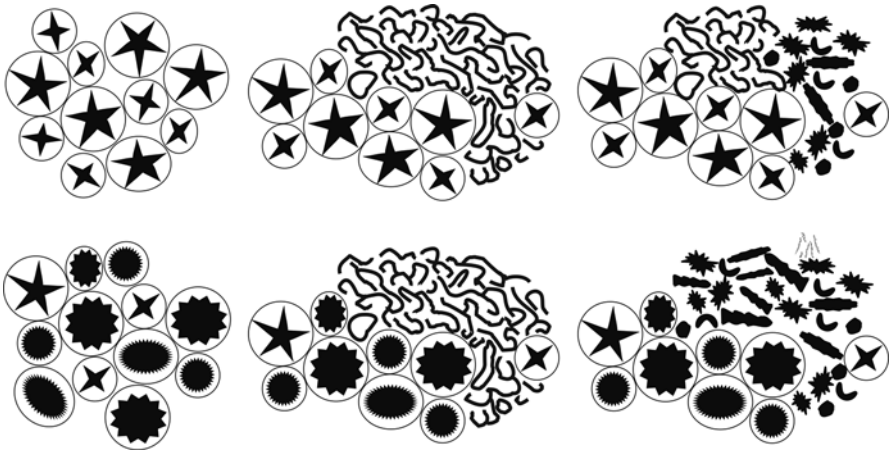


Fig. 10.18 *TSA (upper row)* show stellar PP type II (*left*) alternating or mixed with adenomatous type III (*middle*) or branched type IV (*right*). ***SSA** (lower row)* exhibit wide open oval or stellar-like crypt orifices termed PP type II-O ("open") (*lower left*) that may alternate with or progress to type IV adenomatous (*mid*) or type V invasive neoplastic (*right*) surface pattern (Modified from Kimura et al. [20])

flat serrated adenoma or even serrated adenocarcinoma, whereas mucus adherent to normal mucosa is easily washed off. On histology, the adenoma contains goblet cells and mucin often in dilated and serrated crypts (Fig. 10.19b) – as structural basis for altered pit appearance on imaging. Compared with normal stellar type II pit pattern, the surface pattern typically shows wider and more rounded pit orifices with serrated margins (Fig. 10.18, lower row), named pit pattern *type II-O (open*

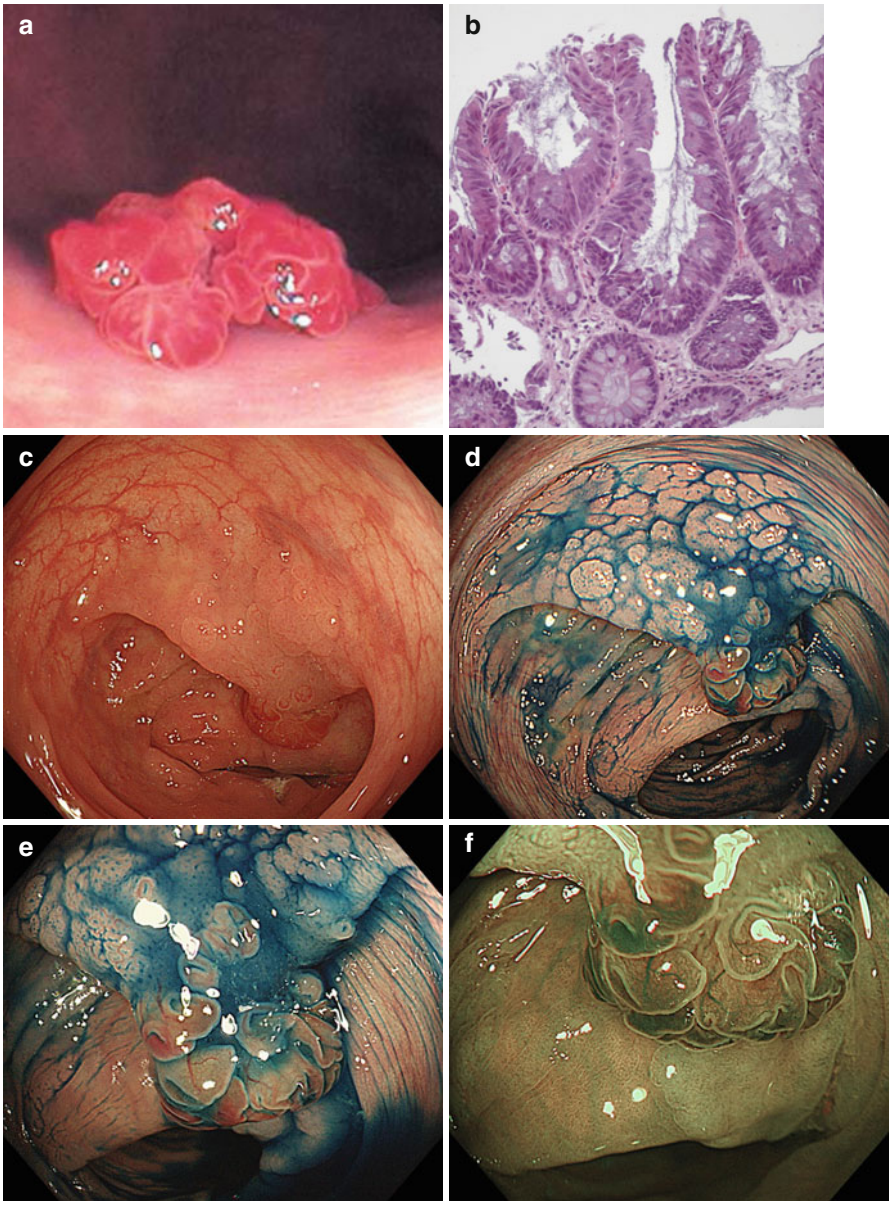


Fig. 10.19 Serrated adenoma (**a**, **b** polypoid; **c**–**f** mixed type). (**a**) Polypoid serrated adenoma (*TSA*) 0-Isp, colon descendens – PP type IVSA ("pineal cone"-like), WLI (Permission by Thieme Medical Publishers, Inc., *Endoscopy* [29]). (**b**) SA, HE stain: serrated crypts with goblet cells and mucin and glandular and cellular atypia. (**c**, **d**) LST-G mixed, isochrome, located in ascending colon, (**c**) WLI, (**d**) indigo carmine. (**e**) PP IVSA (gyrous, *right*) and II and II-O (*left*), indigo carmine M-CE 80×. (**f**) CP II (irregular meshed and dense, *right*) and I (*left*), M-NBI 80×. Histology for (**c–f**): mixed-type serrated adenoma (traditional serrated adenoma and sessile serrated adenoma/polyp)

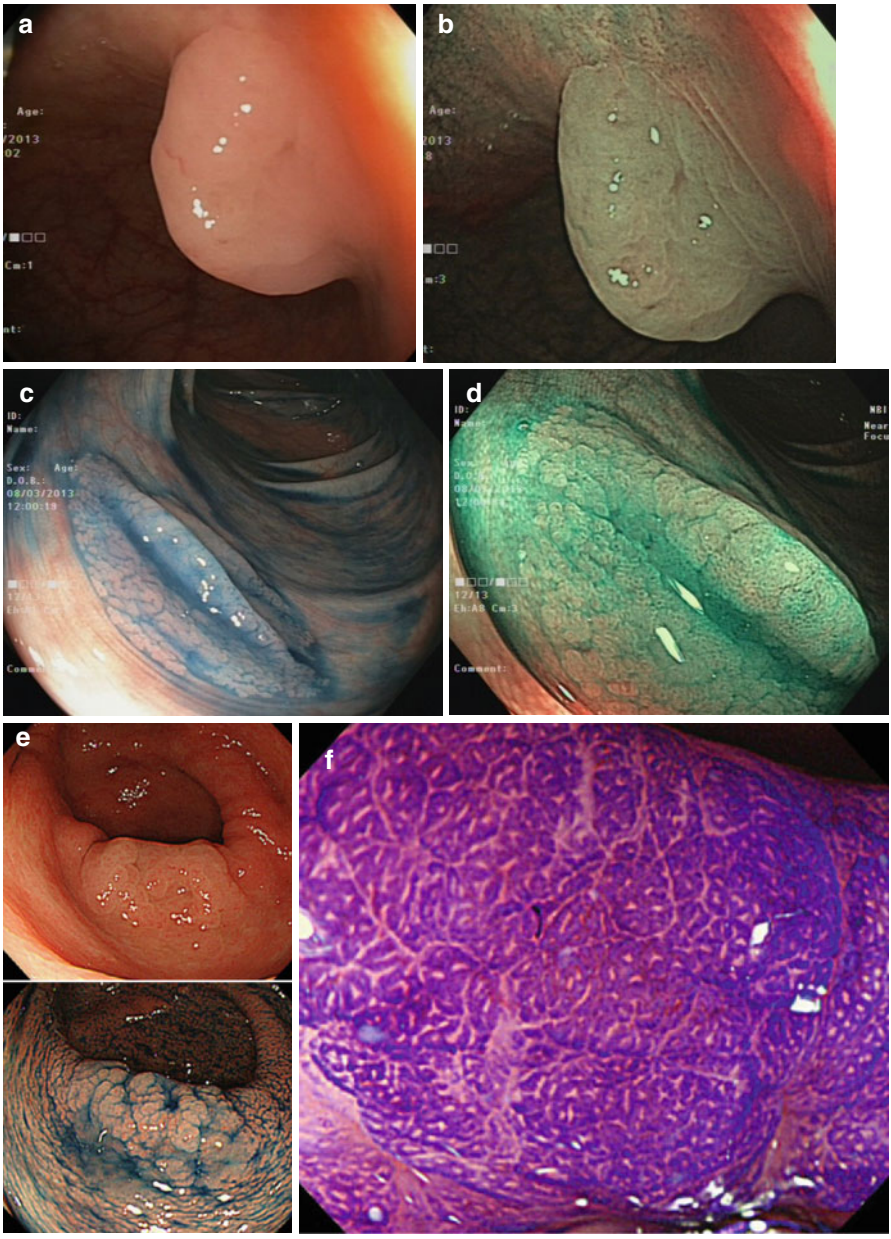


Fig. 10.20 *Sessile serrated adenomas* (confirmed by histology). (**a**, **b**) Pale lesion 0-Is, 15 mm, PP II and CP I, ascending colon, WLI and NBI. (**c**, **d**) Pale LST-NG (0–IIa), PP II and II-O, transverse colon, indigo carmine, WLI and NBI. (**e**) Pale LST-G (0-IIa), ascending colon. WLI, indigo carmine (*bottom left*). (**f**) PP type II magnifying crystal violet CE (80×)

shape) (Fig. 10.20d, f) that may alternate with adenoma-like pattern *type IV or type* IV_{SA} (Fig. 10.19e, f) [20, 29]. *Mixed-type serrated adenoma*, *MSA*, is a variant harboring both *flat hyperplastic* parts (stellar PP II) and *sessile adenoma-like* parts (PP II-O, III, and IV) [30] (Fig. 10.19c–f).

Serrated polyposis syndrome (*SPS)*, formerly named hyperplastic polyposis syndrome (HPS), is characterized by multiple serrated polyps (typically SSA and/or HP) spread throughout the colon. This rare syndrome is associated with multiple SSAs, HPs, conventional adenomas, and increased risk for colon cancer (*serrated adenocarcinoma*) and requires surveillance and removal of all hyperplastic or serrated lesions [19] (Fig. 10.21a–d). By contrast, true *hyperplastic polyposis* may be seen in *rectal prolapse syndrome* (*RPS*) as consequence of chronic recurrent mechanical stress to the distal rectal mucosa (Fig. 10.22c–e) – a condition treatable with laparoscopic rectopexia.

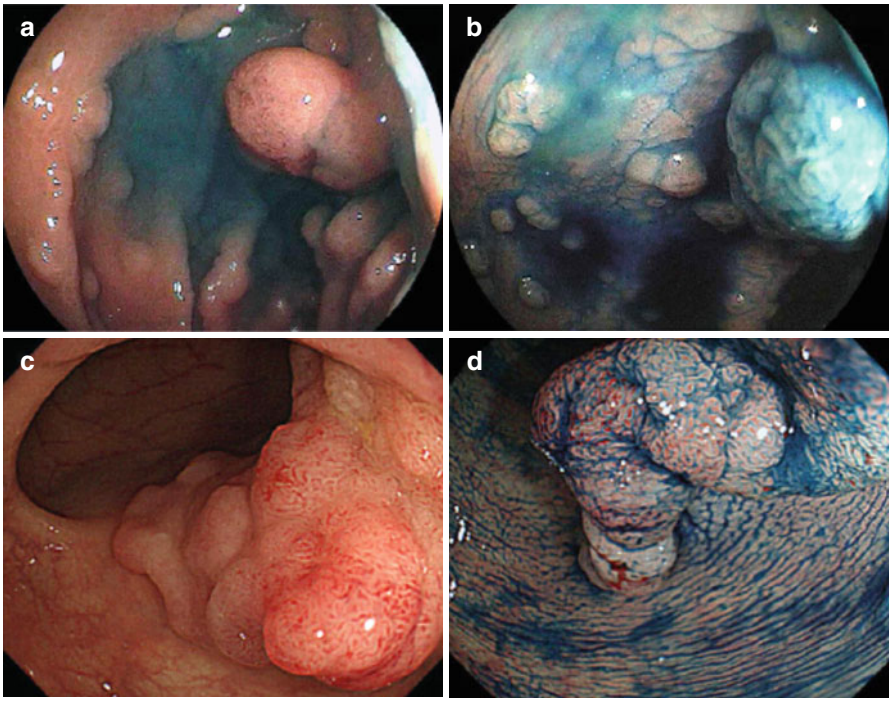


Fig. 10.21 (**a**–**d**) *Serrated polyposis syndrome (SPS)* with multiple serrated adenomas, and 20 mm traditional serrated adenoma (pine cone-like aspect) in ascending colon (>30 hyperplastic/serrated polyps in colorectum). (*Upper panel* **a**, **b**) *TSA and SSA in SPS*, WLI and indigo carmine CE. (*Lower panel* **a**, **b**) Serrated adenocarcinoma (*SAC*) from *SPS patient*. WLI and indigo carmine (From Miwata et al. [15], permission granted by John Wiley and Sons)

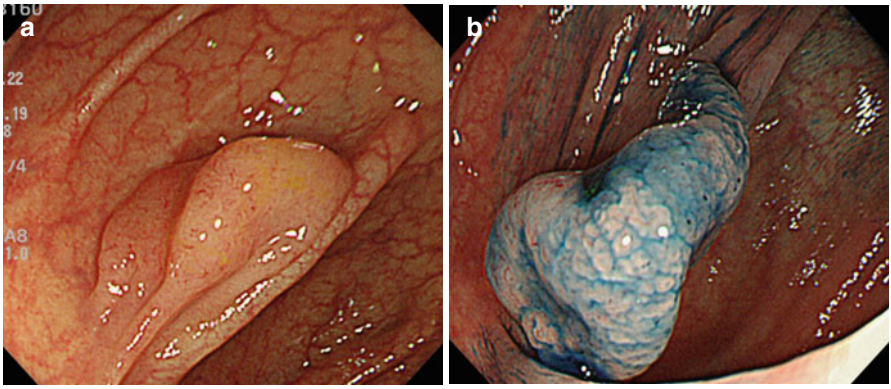


Fig. 10.22 (**a**, **b**) *Hyperplastic polyp 0-Ip*, pale PP II (stellar). WLI and indigo carmine

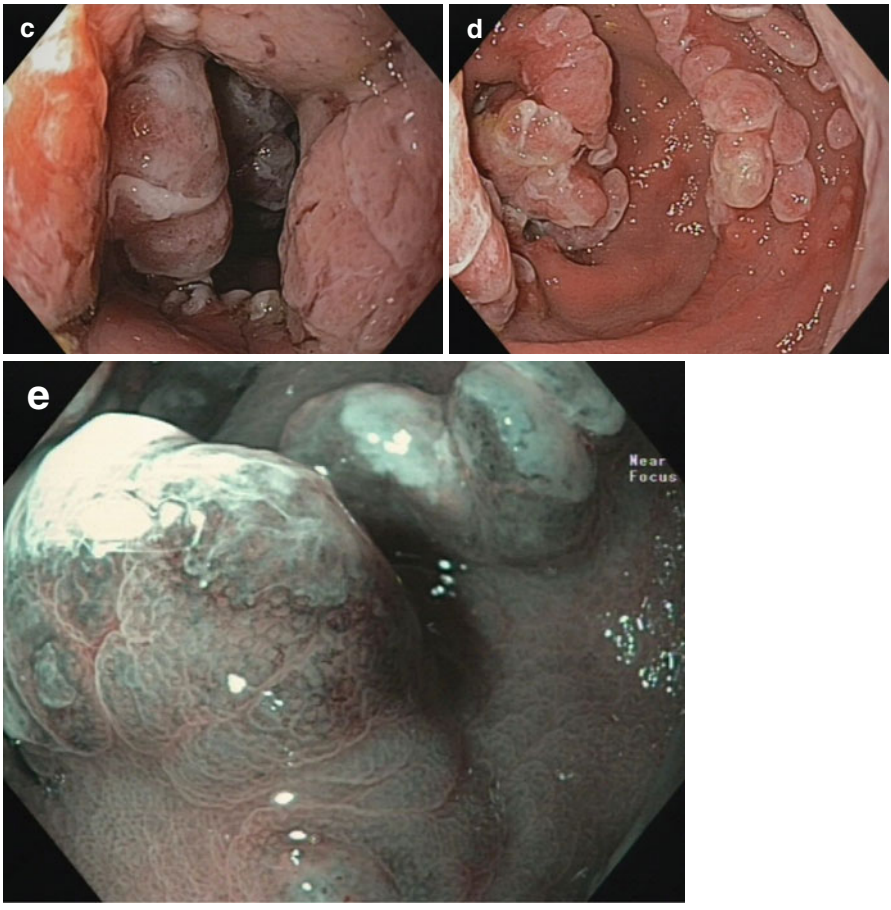


Fig. 10.22 (continued) (**c**–**e**) *Hyperplastic polyposis* (HPS) with rectal prolapse syndrome, (**c**, **d**) mucous and fibrin pseudomembranes on hyperplastic polyps (WLI). (**e**) PP I and II, CP I (meshed), NBI 60×

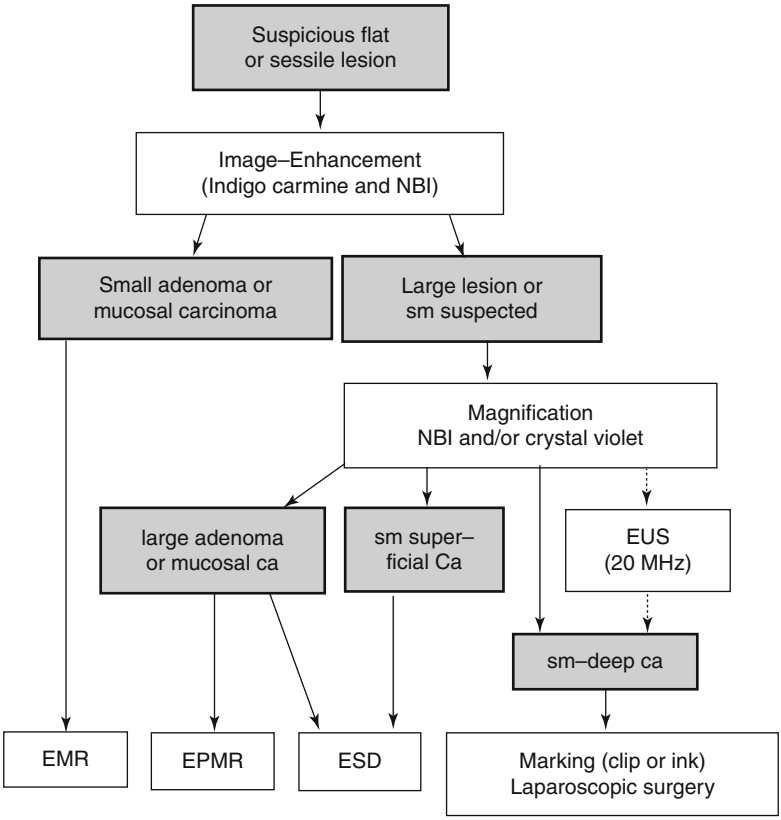


Fig. 10.23 Recommended endoscopic approach for suspicious flat or sessile lesions detected during screening colonoscopy. Endoscopic mucosal resection with snaring (*EMR*) removes small mucosal neoplasias en bloc, and large noninvasive adenoma (–/+HGIN) in piecemeal fashion (*EPMR*). NBI with at least 50-fold magnification should be available for analysis. We recommend crystal violet stain to assess for pit pattern (PP V) characteristic of sm invasion. Hr-EUS (20 MHz) is helpful, when available, but not standard

10.8 Endoscopic Resection of Mucosal Neoplasias

Endoscopic analysis on WLI, M-CE, and M-NBI of macroscopic lesion type, pit pattern, and capillary pattern (CP) is superior to r-EUS (Chap. 5) for the *diagnosis of deep sm-invasive cancer* (Fig. 10.23). In normal colonic mucosa, detection of lateral margins is easy, whereas decision on presence of superficial or deep sm invasion is challenging but is key for resective strategy.

All colonic polyps (0-I lesions) including diminutive polyps are indications for *endoscopic resection*. Polyps <5 mm in size have very low risk for malignancy and are completely removed using biopsy forceps or cold snare [1, 2]. Removal of hyperplastic polyps smaller than 5 mm, in particular multiple hyperplastic polyps in the rectum (positive predictive value ~80 %), is not generally considered necessary [1].

Note
All hyperplastic lesions proximal to the sigmoid colon and hyperplastic lesions in the rectosigmoid >5 mm in size, as well as all serrated lesions must be completely removed [31].

Snare polypectomy (without sm injection under the polyp) is the preferred ablation procedure for semipedunculated/pedunculated or sessile polyps (adenomas +/– focal carcinomas). *Suction pseudopolyp snaring* is a quick and suitable technique for safe resection with free margins of small (<10 mm) *flat mucosal neoplasias* (0-IIa and 0-IIb). To this end, the small lesion is aspirated into the suction channel of the colonoscope and the suction applied for 5 s while the colonoscope is gently retracted for a distance of 2–5 cm. The suction pseudopolyp bearing the flat lesion is snared immediately after its release from suction [32].

Endoscopic mucosa resection (EMR) removes slightly larger sessile or flat neoplasias (diameter 10–20 mm) en bloc with free margins.

Indications for EMR [33, 34]:

- Adenomas of superficial flat type (0-IIa/IIb; PP type IIIL, IV, [IIIs]), diameter ≤20 mm
- Neoplasias of depressed type (0-IIc; PP IIIs and lifting sign upon sm injection), diameter ≤ 15 mm
- Laterally spreading tumors of homogenous granular type (LST-GH) without signs of submucosal invasion (piecemeal EPMR)

Limitations of large-sized EMR [33, 35–37]:

- Lesions exceeding 2 cm diameter are not resectable en bloc
- Submucosal fibrosis, e.g., in chronic inflammatory disease
- Technical limitations for snaring (e.g., mucosal folds, colonic angulation, small rectal carcinoid tumors, etc.)
- High rate of local recurrence (up to 30 %) after piecemeal-EMR of HGIN or mucosal cancer

10.8.1 Piecemeal-EMR

EMR has limitations such as piecemeal resection for flat lesions larger than 20 mm, resection of lesions involving the dentate line or the ileocecal valve, and resection of lesions with a non-lifting sign. Piecemeal resection results in less accurate histological assessment and often leads local recurrence.

In case of resection of *LST-G* with piecemeal-EMR, *areas with risk* of sm-invasive carcinoma (large nodule, depressed area in LST-G) must *first be resected en bloc*, before the rest of the lesion is snared in piecemeal fashion [10, 34]. Nevertheless, we prefer ESD for *complete en bloc resection (R0)* of LST-G suspicious for malignant foci.

Complications of EMR are [33, 35, 36]:

- Perforation (risk 4–5 %, higher in cases with "technical limitations")
- *Post-polypectomy coagulation syndrome* (risk 0.5–1.2 %) with high risk of delayed bowel perforation and severe peritonitis
- *Recurrent or late bleeding* (risk ~5 %) at the EMR site

Note
Local recurrence of adenoma or intramucosal/sm-microinvasive cancer (G1 or G2, Ly 0) does not occur, when the entire tumor has been removed intact with free margins (R 0). The risk of lymph node metastasis is near zero percent, when lymphovascular invasion (Ly 0, V 0) and tumor budding are absent and depth of submucosal invasion is <1,000 μm [38, 39]. By contrast, piecemeal snaring of such neoplasias carries a high risk of recurrence (up to 30 %) [40].

Endoscopic submucosal dissection (ESD) is more difficult in colon than in stomach or esophagus, but became standard even in the colon [41]. Good results are reported from experienced centers [41–44], but you should weigh the risks against benefits when you decide on ESD indications in colon and not overuse ESD for low-risk neoplastic lesions [34].

Indications for ESD (preliminary criteria) [10, 34, 38, 41, 45, 46]:

Any *neoplasias >20 mm* in diameter, indicative for en bloc mucosal resection:
LST-NG
LST-G (villous adenoma +/− HGIN) with d > 30 mm[a]
Mucosal HGIN or carcinoma G1 or G2 without signs of deep sm invasion (superficial sm invasive <1,000 μm)
Depressed lesions (type 0-IIc)
Lesions type 0-Is/Isp or 0-II with type V_I pit pattern
Neoplasias unamenable to snare EMR techniques because of scars, location on haustral folds, or angulation of the colon
Sporadic localized tumors in chronic ulcerative colitis
Colorectal carcinoids of diameter <20 mm (EMR, when d <10 mm)[b]

[a]LST-GM may also be resected in piecemeal fashion, the larger nodule resected first [10]
[b]If separated from the proper muscle layer on high-resolution EUS, some SMT can be resected with ESD [45]

Indication for a priori surgical resection:

- Signs of deep submucosal invasion of proven carcinoma [34, 45]

10.9 Cases: Adenomas, Dysplasia, and Early Colorectal Cancer

Case 1: Small Lesion 0-Is + 0-IIc Located at the Sigmoid Colon
A small lesion 0-IIc with central bulging (0-Is), 8 mm in diameter, was detected on a haustral fold in sigmoid colon. Magnifying view (80×) with crystal violet staining revealed highly irregular-type Vi pit pattern, and Hr-EUS (20 MHz) disclosed a 4 mm wide break in the sm echo band. Both findings supported deeply sm-invasive cancer – a diagnosis further strengthened by complete non-lifting sign of the lesion upon sm injection of fluid. The patient underwent curative laparoscopic resection: adenocarcinoma (tub2), pT1bsm (2,000 μm), ly1, v0, pPM0, pDM0, pRM0, and 0-Is + IIc (Fig. 10.24).

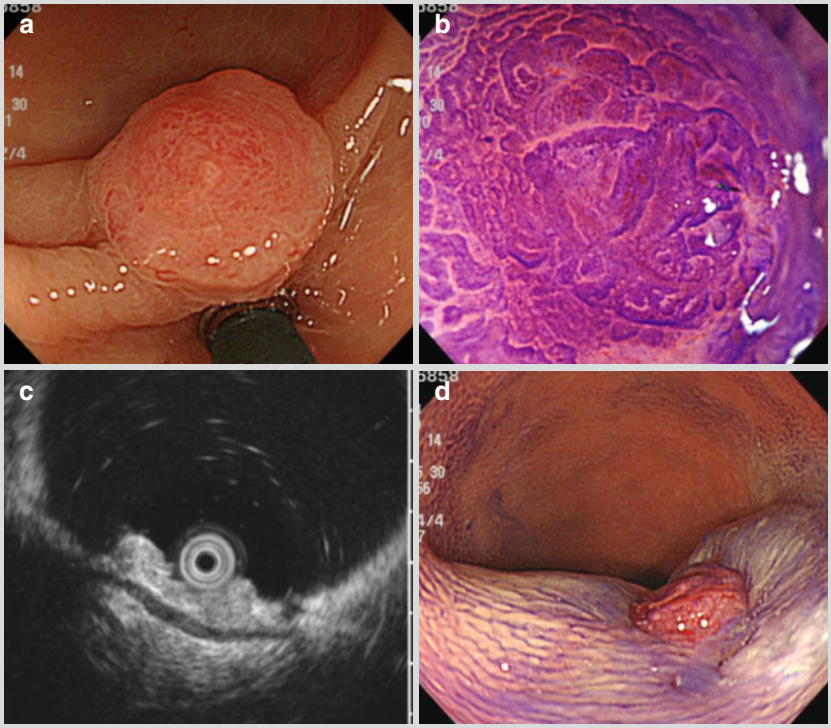


Fig. 10.24 (**a–d**) *Lesion 0-Is + IIc* (d 4 cm, *bulging in IIc*) on haustral fold in sigmoid colon. (**a**) WLI; (**b**) crystal violet CE (WLI, 80×), PP type V_I *high grade*; (**c**) radial hr-EUS, 4 mm wide *break in sm echo layer*. (**d**) Complete *non-lifting sign* after sm injection of 3 × 2 ml fluid. *Surgery*: well-differentiated AC, pT1b, *deeply sm invasive* (2,000 μm), ly 1 v 0

Note
All 4 signs of sm invasiveness when combined (macroscopic/PP/EUS/non-lifting) allow highly accurate diagnosis.

Case 2: LST-NG Located at the Sigmoid Colon
Screening colonoscopy presented a typical LST-NG, 4 cm in diameter, with slight central pseudodepression extending over a haustral fold in sigmoid colon (Fig. 10.25). IEE analysis suggested *intramucosal cancer*; ESD en bloc using Flex knife was performed.

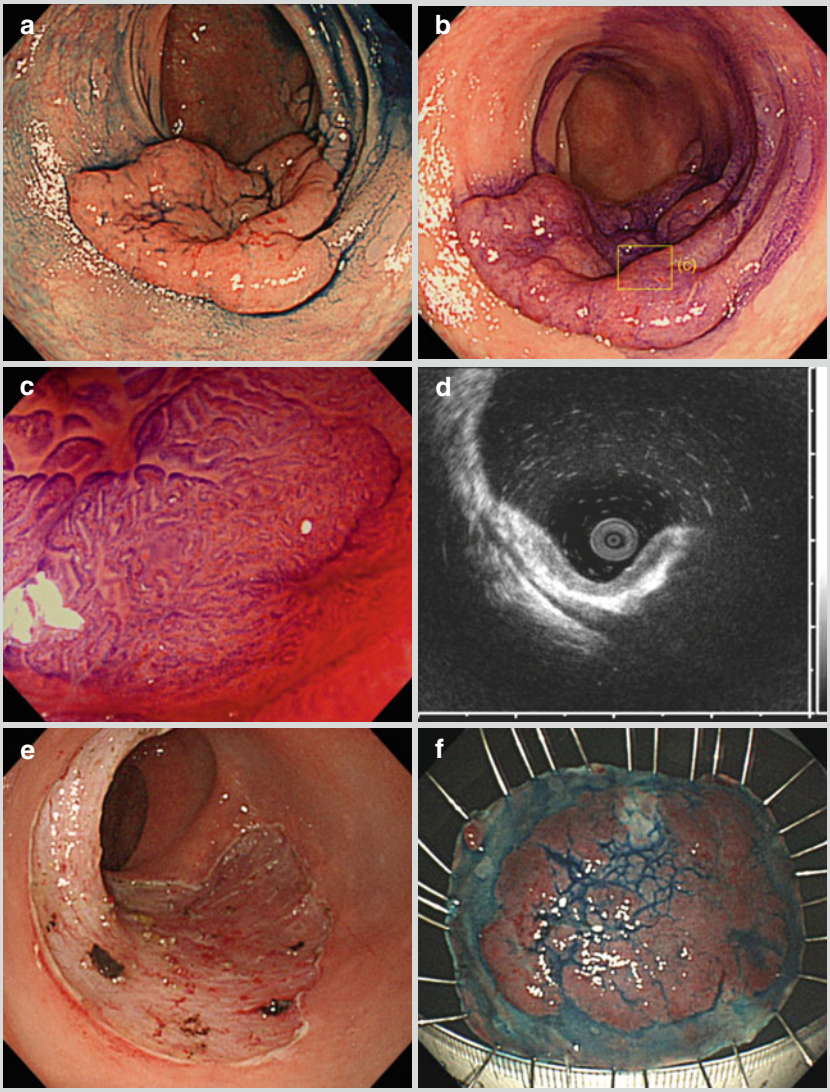


Fig. 10.25 (**a–f**) *LST-NGPD* (d 4 cm) in sigmoid colon. (**a**) Indigo carmine CE. (**b**) Crystal violet CE. (**c**) M-CE (80×) with crystal violet stain: PP type V_I *low grade*. (**d**) Radial hr-EUS shows *intact sm echo layer* (white echo band). (**e**) Resection bed . (**f**) ESD specimen (indigo carmine). Histol.: adenocarcinoma, pT1b*sml*(990 µm), tub1, ly0, v0, HM0, VM0

Note

ESD for cure is attempted on LST-NGPD, unless you diagnose clear sign(s) of deep sm invasion.

Case 3: Small Lesion 0-IIa+c at the Sigmoid Colon
Screening colonoscopy in a 77-year-old woman showed a small (d 1 cm) lesion type 0-IIa+c with PP type IIIs (Fig. 10.26a) at inner curve of the recto-sigmoid flexure. (**b**) Simplified ESD with final snaring resected the lesion en bloc, (**c**) without thermal damage to resection bed nor (**d**) to the specimen that revealed tubular adenoma with HGIN, resected R0.

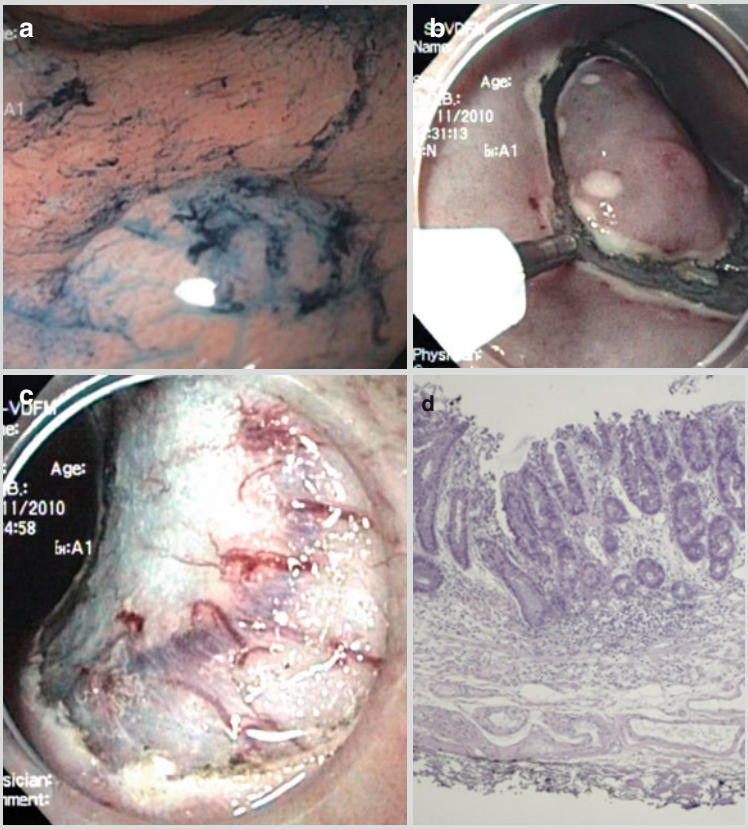


Fig. 10.26 (**a**) Small lesion type 0-IIa+c with PP IIIs on M-CE (20×) using indigo carmine. (**b**) Simplified ESD with final snaring, (**c**) bare resection bed, (**d**) cross section of the specimen showing tubular adenoma with focal HGIN, and no thermal damage at deep margin

Note
Simplified ESD (with low-power snaring of final sm bridge) provides:

- Shorter procedure time (during the learning curve)
- High-quality ESD specimen without thermal artifacts for histology

Case 4: LST-G Whole Nodular Type (0-Is+Isp), Sigmoid Colon
A polypoid lesion, LST-GN of whole nodular type, at sigmoid colon showed signs of deep sm invasion (Fig. 10.27), a contraindication for snaring polypectomy.

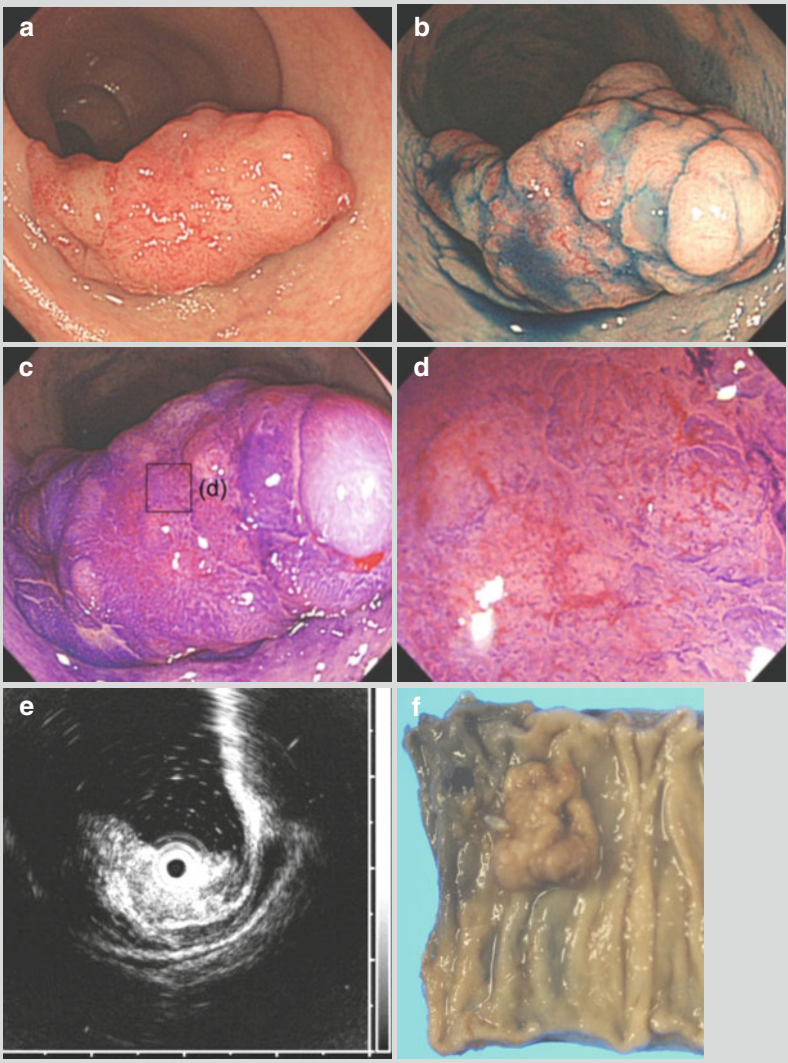


Fig. 10.27 LST-G whole nodular type (0-Is+Isp), 20 mm in diameter on (**a**) WLI, (**b**) indigo carmine, and (**c**) crystal violet CE which disclosed (**d**) focal areas with *PP type* V_I *high grade*. (**e**) Hr-EUS (20 MHz) showed a *break of sm echo band* underneath the lesion. (**f**) Specimen of laparoscopic resection: adenocarcinoma G1, pT1b*sm2, ly1, v1*, pN0

Note

- Accurate endoscopic analysis of neoplastic polyps prevents polypectomy (R2 resection) on deeply sm-invasive cancer type 0-Is/p.

Case 5: Large Rectal LST-G Mixed Type Invading Anal Channel
Rectal LST-G mixed type (0-IIa + Is) consisting of homogenous granular parts and one triangular-shaped sessile lesion (4 × 3 cm, 1 cm elevated) was diagnosed in a woman in her mid-forties. Indigo carmine CE showed PP type IIIL and IV (Fig. 10.28a–d) and on the sessile part some PP type IIIs but no ulcerations, friability, or distinct signs of deep submucosal invasion. Surgical full-wall resection would certainly have interfered with anal function and fecal continence. Therefore, she favored diagnostic ESD en bloc. Circular dissection of anal margin and anal channel in prograde fashion followed by stepwise partial circumferential incision and subsequent submucosal dissection in retroflex fashion allowed to resect the entire lesion en bloc with safety margins, including the sm vascular plexus.

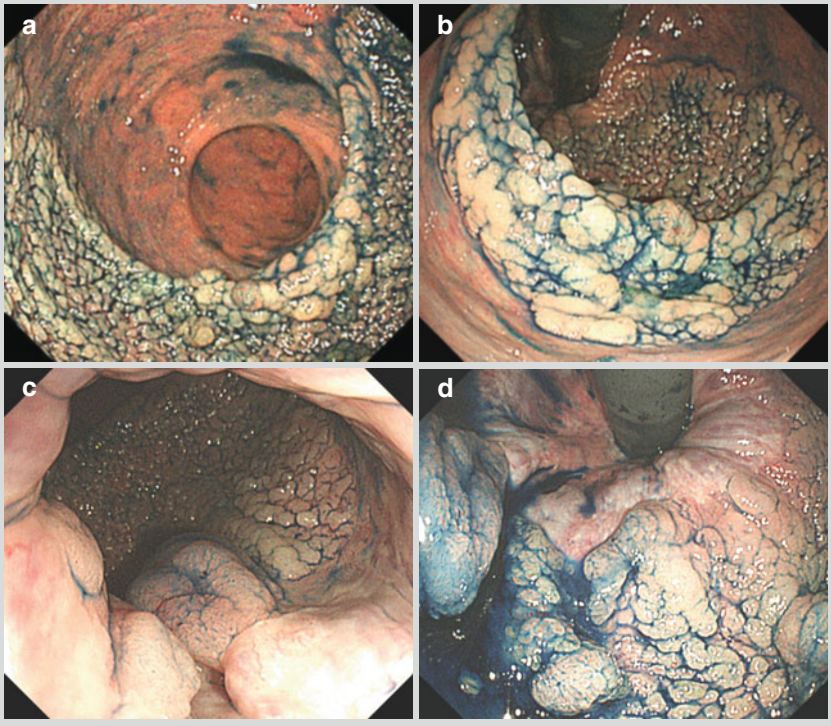


Fig. 10.28 (**a**–**d**) Large LST-G mixed type (0-IIa + Is), extending about 9 cm from squamocolumnar junction (**c**, **d**; 70 % circumferential) at the posterior wall over the Houston fold (**a**, **b**) into the rectum (WLI, indigo carmine CE)

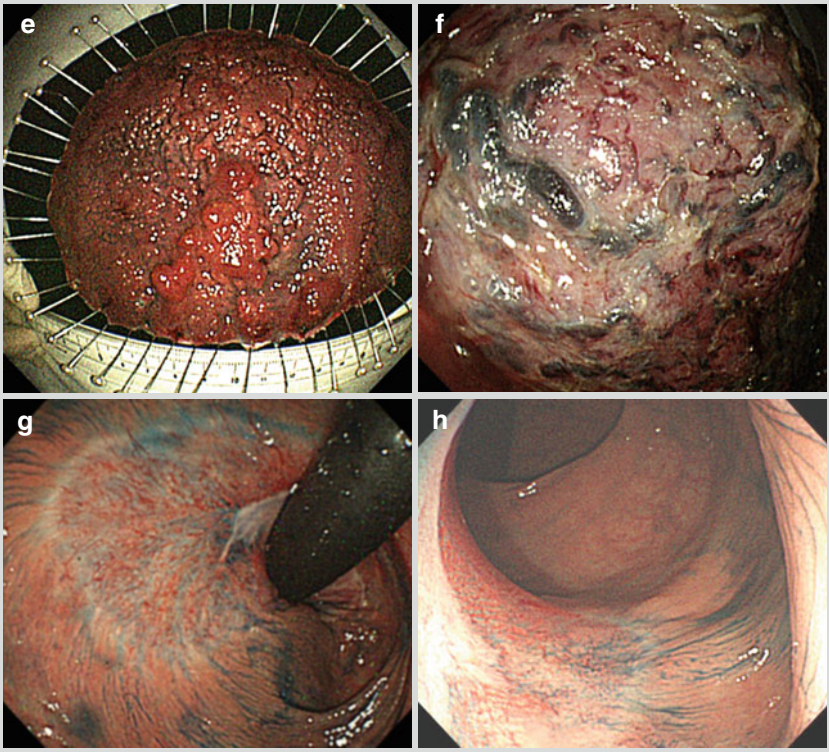


Fig. 10.28 (continued) (**e**) Specimen was resected by dual knife with safety margin and (**f**) intact sm vascular stratum (sml-2); submucosal view of specimen → *histopathology*: *focal differentiated adenocarcinoma*, *depth M*, in tubulovillous adenoma 130 × 103mm, ly0, v0, pLM0, pVM0; curative resection R0. (**g**, **h**) Follow-up rectoscopy after 6 months showed a scar after ESD with regenerative mucosa and no narrowing of the anal channel

Note

ESD en bloc of advanced adenoma or mucosal cancer of anorectum can provide cure and preserve normal anorectal function.

Case 6: Relatively Large Cecal Lesion LST-G Whole Nodular (0-Is)

On complete colonoscopy performed for positive fecal occult blood test, a lesion 0-Is, whole nodular, 5 × 3 cm in size was found located on the last lateral haustral fold of the cecum. Detailed endoscopic analysis was performed and ESD conducted for diagnostic and possibly curative intention (Fig. 10.29).

Laparoscopic hemicolectomy with lymph node dissection was recommended.

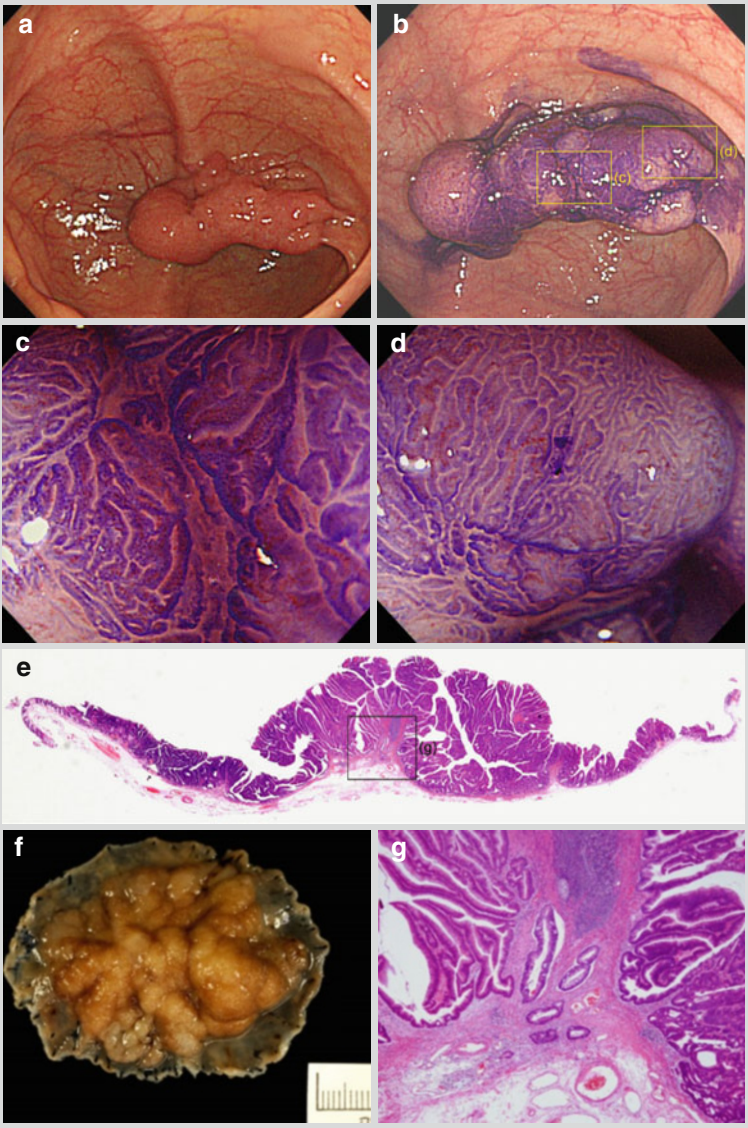


Fig. 10.29 (**a**) A lesion 0-Is, whole nodular, 5×3 cm in size on the last lateral haustral fold of the cecum. (**b**) On crystal violet CE, the lesion showed PP type IIIL and IV and irregular PP V in small depressed areas (insert c, d) which revealed on M-CE (80×) (**c**) PP type Vi low grade and (**d**) PP type Vi high grade. (**f**) ESD en bloc performed for diagnostic purpose yielded a single specimen of the entire lesion with safety margins, (**e**) sequential transversal sections showed lateral and vertical margins negative. (**g**) *Histology*: adenocarcinoma, tub1, size 50×35 mm (specimen 55×40 mm), sm1 (500 μm), ly0, *v1*

Note

High-quality ESD specimens allow for precise histopathologic staging to guide decisions on clinical management of cancer.

Case 7: LST-NG (Sized ~5 cm) Located at the Transverse Colon
In this 76-year-old male receiving anticoagulant therapy, colonoscopy was performed for chronic anemia. Irregularity of colonic mucosa at transverse colon was pointed out and analyzed (Fig. 10.30a–j).

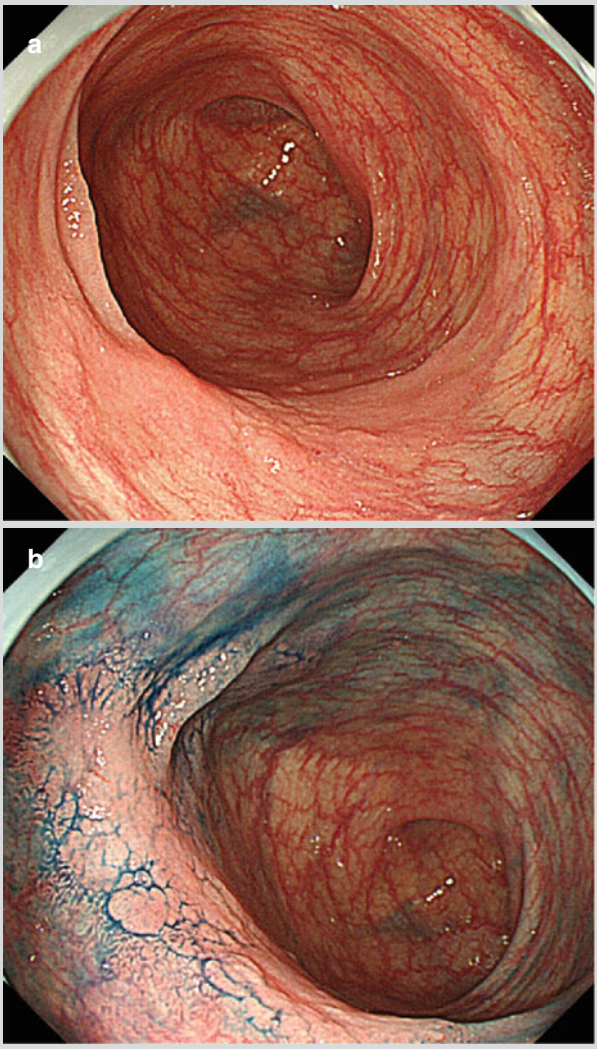


Fig. 10.30 (**a**) Reddish surface irregularity with loss of sm vascular pattern (*bottom*). (**b**) Indigo carmine spraying revealed a flat lesion 0-IIb, further analyzed by magnifying imaging (80×) using

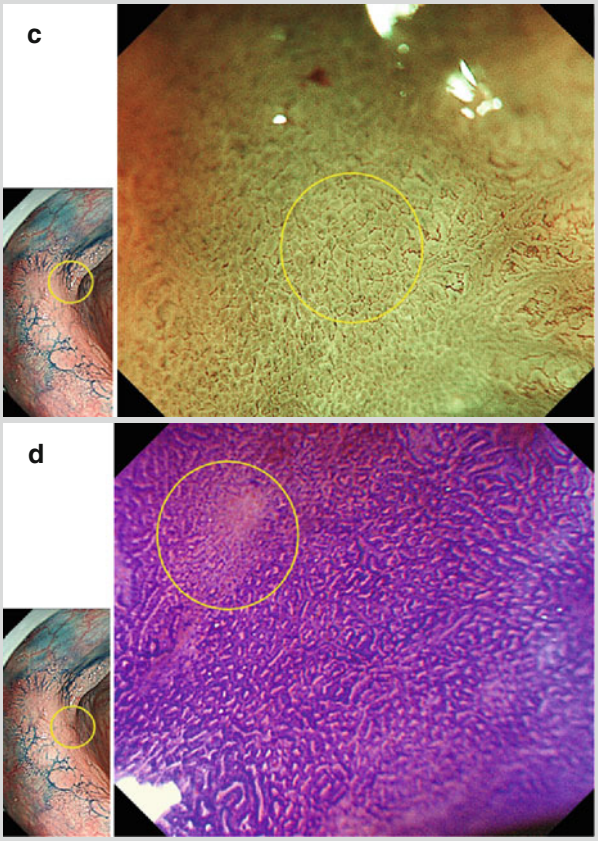


Fig. 10.30 (continued) (**c**) NBI (CP IIIA) and (**d**) crystal violet (PP V_i low grade). One tiny spot showed

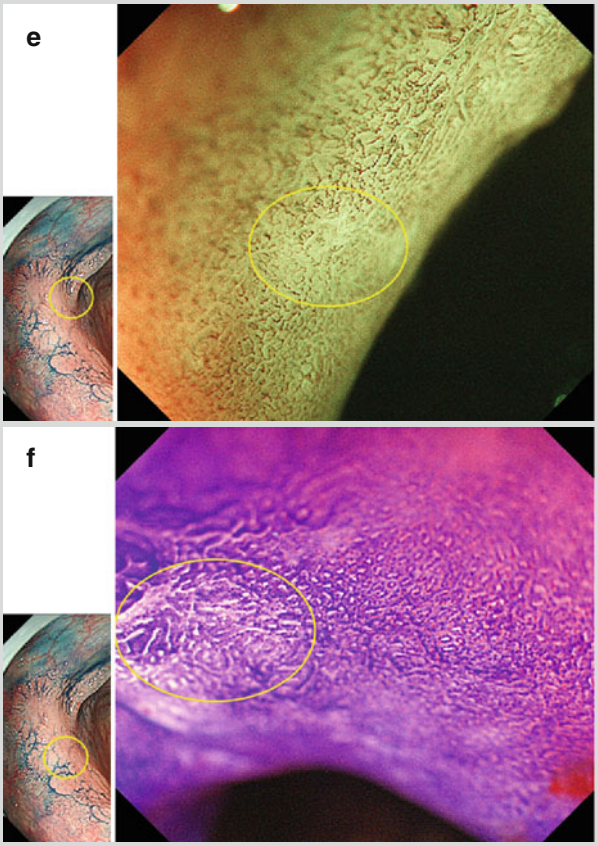


Fig. 10.30 (continued) (**e**) CP IIIB on NBI and (**f**) PP V_I high grade on crystal violet CE. *Clinical diagnosis*: LST-NG suspicious for sm-invasive, differentiated adenocarcinoma, diameter nearly 5 cm. ESD was recommended (for diagnostic purpose)

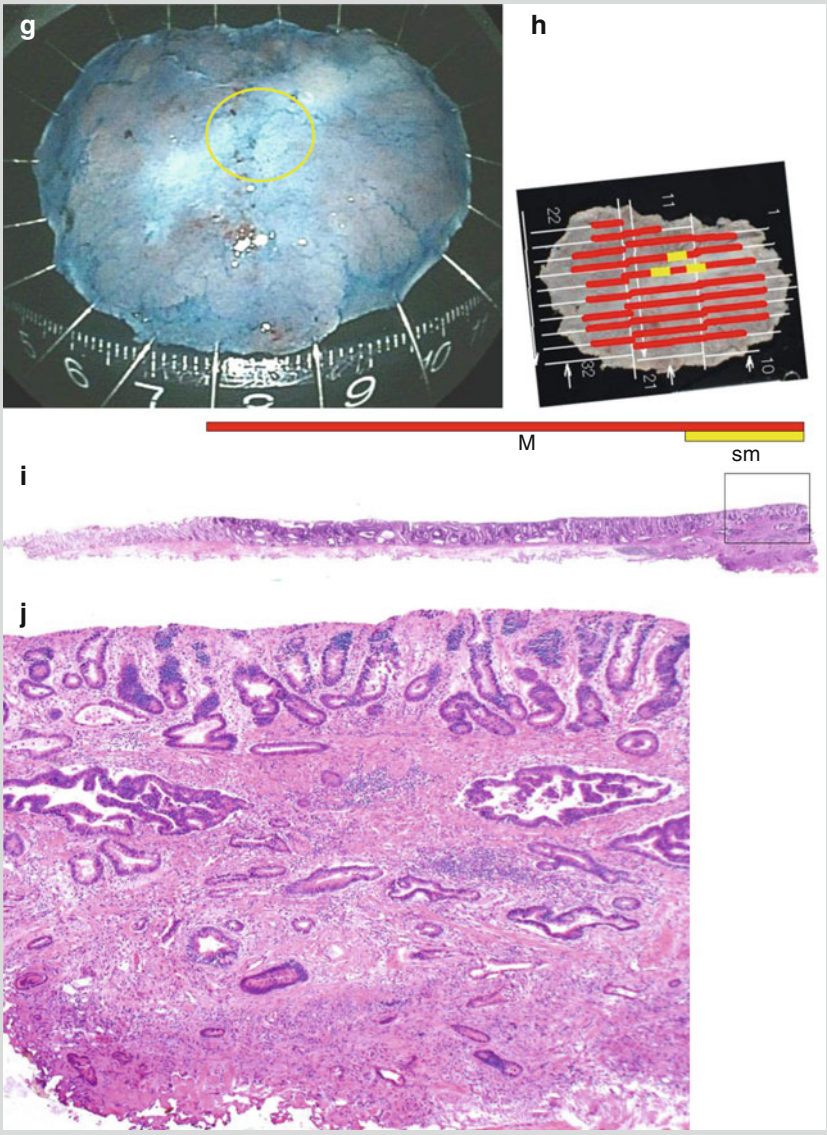


Fig. 10.30 (continued) (**g**) The specimen with safety margin was pinned and documented (*suspicious area marked*). (**h**) Specimen sections mapped for intramucosal (*red*) and sm-invasive (*yellow*) cancer, (**i**) section (HE stain) with maximum sm invasion (j), and (**j**) HE stain 100-fold. *Histopathology*: adenocarcinoma, tub1 > tub2, 48 × 37 mm, p*sm* >*3,000 μm*, ly0, v0, HM0, *VM1* hemicolectomy and LN dissection was recommended

Note

- ESD can provide precise histological information, especially when the pathologist is informed about suspicious areas.
- This may change clinical strategy for cancer therapy.

Case 8: Rectal LST-G (Sized ~5 cm)
Total colonoscopy was performed for positive fecal occult blood test in this 48-year-old female. A large rectal lesion (~5 cm) was pointed out (Fig. 10.31).

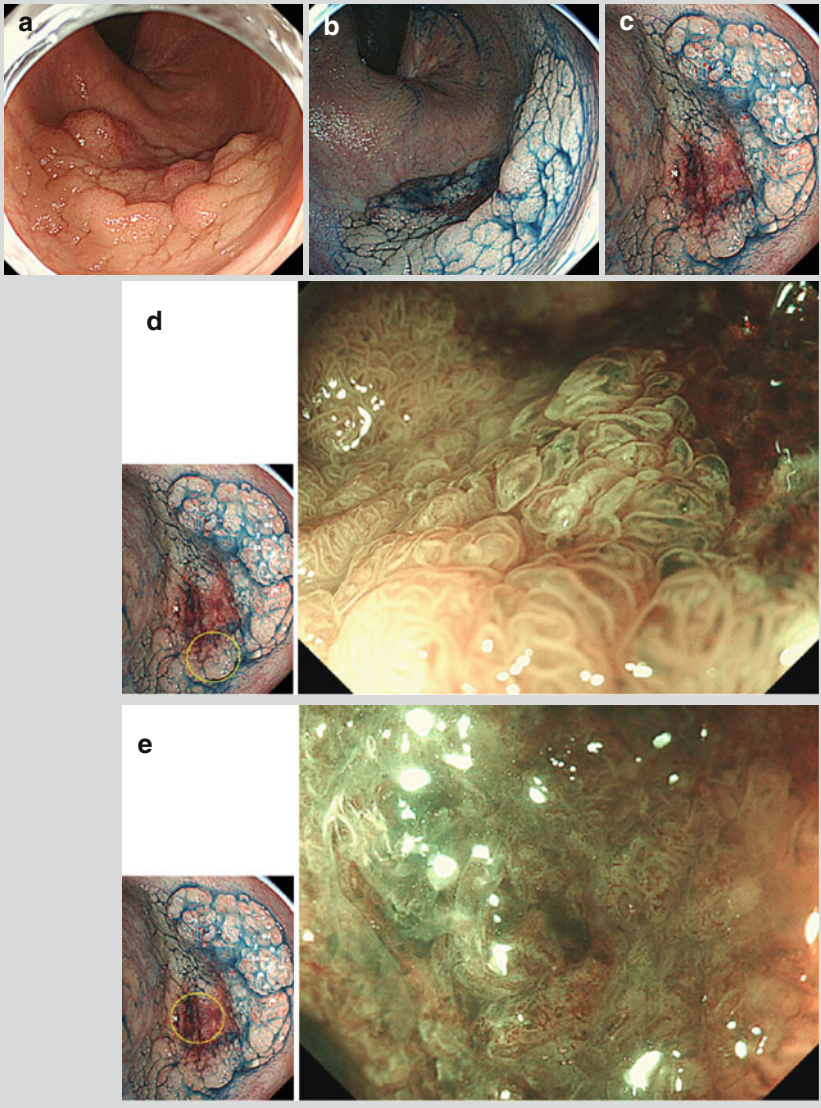


Fig. 10.31 (**a**) Rectal *LST-G (0-IIa + c)*, d ~ 5 cm, on WLI and (**b**, **c**) indigo carmine CE. (**d**) CP type II (in 0-IIa margin, *left*) and (**e**) CP type IIIA (in 0-IIc lesion, *left*) on magnifying NBI (80×)

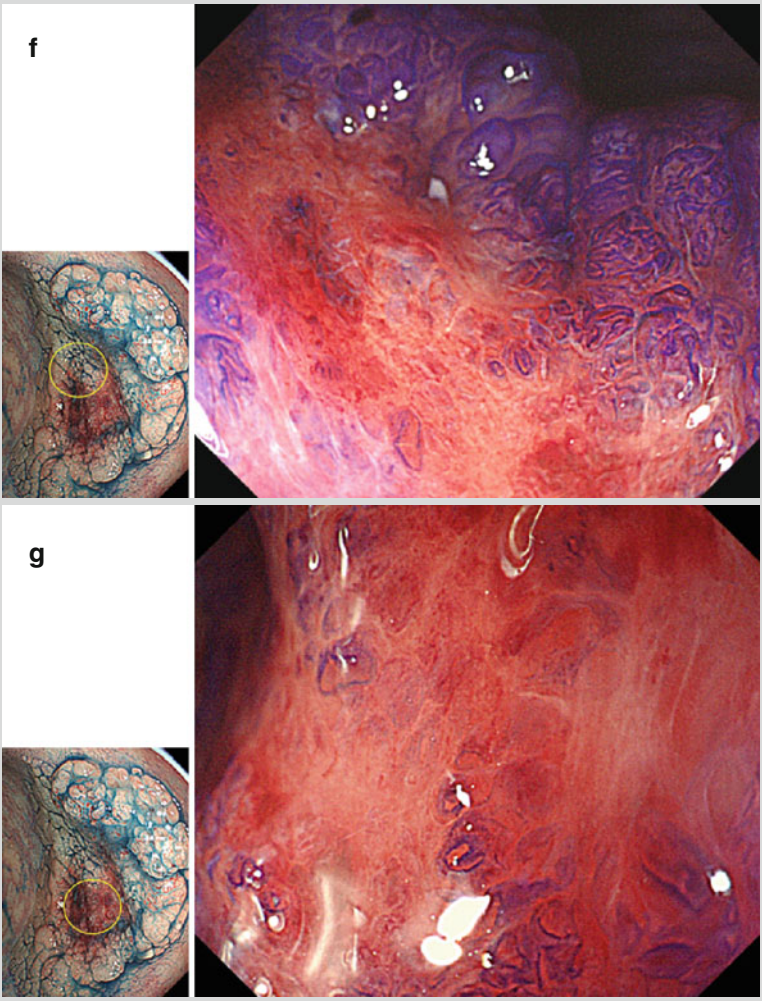


Fig. 10.31 (continued) Crystal violet stain (with little sticky mucus) shows (**f**) PP type IIIL in 0-IIa and (**g**) PP type VN in 0-IIc part. *Clinical diagnosis*: *LST-G with massively sm-invasive cancer*, sized 5 cm. ESD was attempted for diagnostic purpose

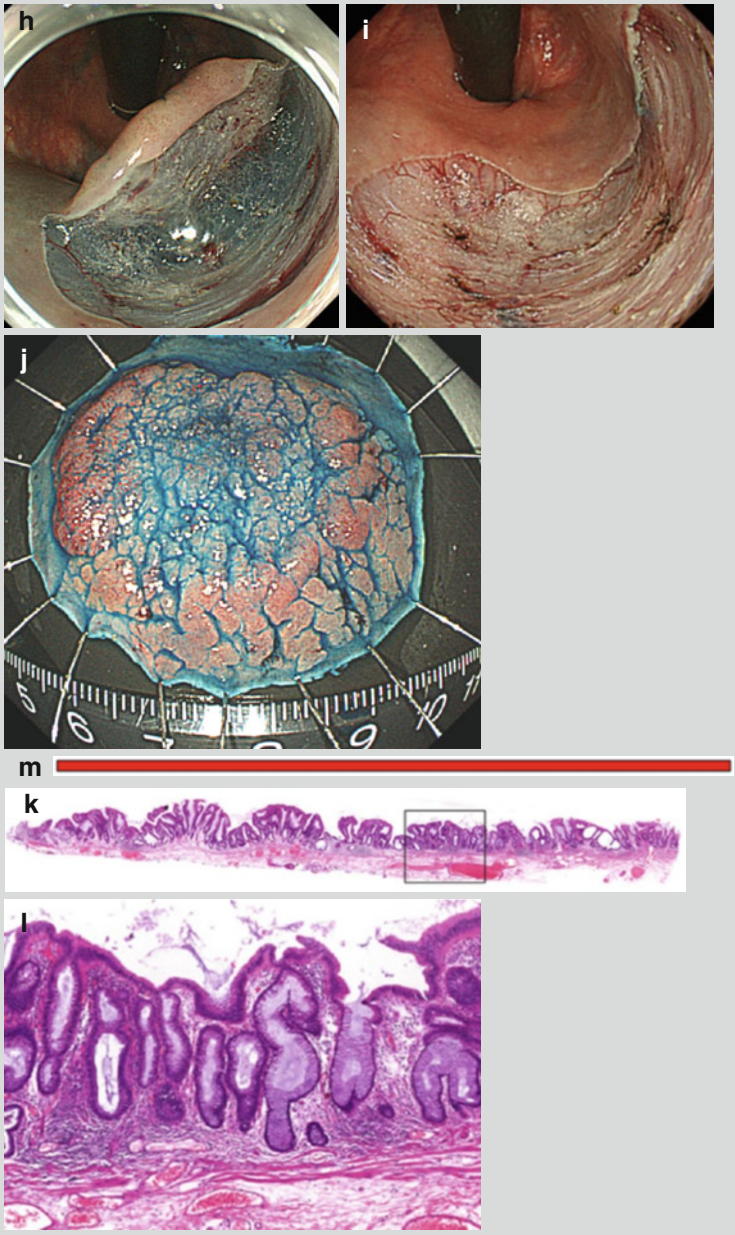


Fig. 10.31 (continued) (**h**) sm lifting during ESD was normal, and (**i**) resection with ESD was complete. (**j**) ESD specimen (indigo carmine): the surface structure of the neoplasia was slightly irregular after clearance of mucus. *Histology*: (**k**) noninvasive (*M*) tubulovillous adenoma (HE stain, box **l**) with (**l**) focal high-grade dysplasia (HE stain, 100-fold)

Note

- Preoperative endoscopic diagnosis is not always perfect.
- Consider diagnostic ESD for precise histopathologic evaluation when preoperative diagnosis is uncertain, before recommending major surgery.

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