ENDOSCOPIC DIAGNOSIS OF COLORECTAL NEOPLASM

PIT PATTERN DIAGNOSIS FOR COLORECTAL NEOPLASIA USING NARROW BAND IMAGING MAGNIFICATION

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Narrow band imaging (NBI) is a newly developed technology that uses optical filters for RGB sequential illumination and narrows the bandwidth of spectral transmittance. NBI enables the observation of the fine capillaries in the superficial mucosa of the gastrointestinal tract. In this report, the authors assessed the clinical usefulness of NBI magnification in pit pattern diagnosis for colorectal neoplasia. A total of 90 colorectal lesions including nine cases of hyperplasia, 60 of tubular adenoma and 21 of early carcinoma were analyzed. Histologic diagnosis was undertaken according to World Health Organization classifications. Magnified observation of the lesions was performed using NBI without chromoendoscopy, and pit pattern diagnosis was then recorded. After endoscopic or surgical resection of the lesion, the authors performed stereoscopic examination to confirm the pit pattern. From these data, the authors estimated the ability to diagnose pit patterns using NBI magnification without chromoendoscopy. The correspondence rate of pit pattern diagnosis between NBI magnification without chromoendoscopy and stereoscopic findings was 100% (9/9) for type II, 100% (56/56) for type IIIL, 100% (3/3) for type IV, 80% (12/15) for type VI, and 57% (4/7) for type VN. NBI magnification without chromoendoscopy demonstrated good results for pit pattern diagnosis of colorectal neoplasia, especially for lesions with regular pit pattern.

Key words: colorectal neoplasia, magnification, narrow band imaging, pit pattern.

INTRODUCTION

Narrow band imaging (NBI) is a newly developed technology that uses optical filters for RGB sequential illumination and narrows the bandwidth of spectral transmittance.[1–4] It enables observation of the fine capillaries in the superficial mucosa of the gastrointestinal tract.[1–4] The clinical usefulness of NBI has been reported previously in detailed endoscopic observations of head/neck carcinoma,[5] superficial esophageal carcinoma,[6–8] early gastric carcinoma[9] and colorectal neoplasia.[10] In the colorectal field, Machida *et al.*[11] reported that NBI observation is useful for differential diagnosis between neoplasia and non-neoplasia, being as good as standard magnification or chromoendoscopic examination.

Recently, pit pattern diagnosis using a magnifying colonoscope has been established.[12–18] The clinical significance of pit pattern diagnosis in the colorectal field is the differential diagnosis between neoplasia and non-neoplasia, diagnosis of the degree of histologic atypia of a tumor, invasion depth diagnosis of early carcinomas, detection of minute residual tumors after endoscopic resection, estimation of the degree of histologic inflammation in ulcerative colitis, and the diagnosis of dysplasia/colitis associated carcinomas in ulcerative colitis. Usually, standard magnifying observation needs the use of chromoagents in the diagnostic procedures, such as indigo carmine or crystal violet, to clarify the pit structure. More simple and convenient procedures are desirable for the magnifying procedures.
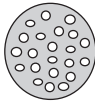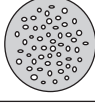
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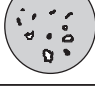
I		Round pit (normal pit)
II		Asteroid pit
IIIS		Tubular or round pit that is smaller than the normal pit (Type I)
IIIL		Tubular or round pit that is larger than the normal pit (Type I)
IV		Dendritic or gyrus-like pit
VI		Irregular arrangement and sizes of IIIL, IIIS, IV type pit pattern
VN		Loss or decrease of pits with an amorphous structure

Fig. 1. Pit pattern classification for colorectal neoplasia (Kudo & Tsuruta[19]).
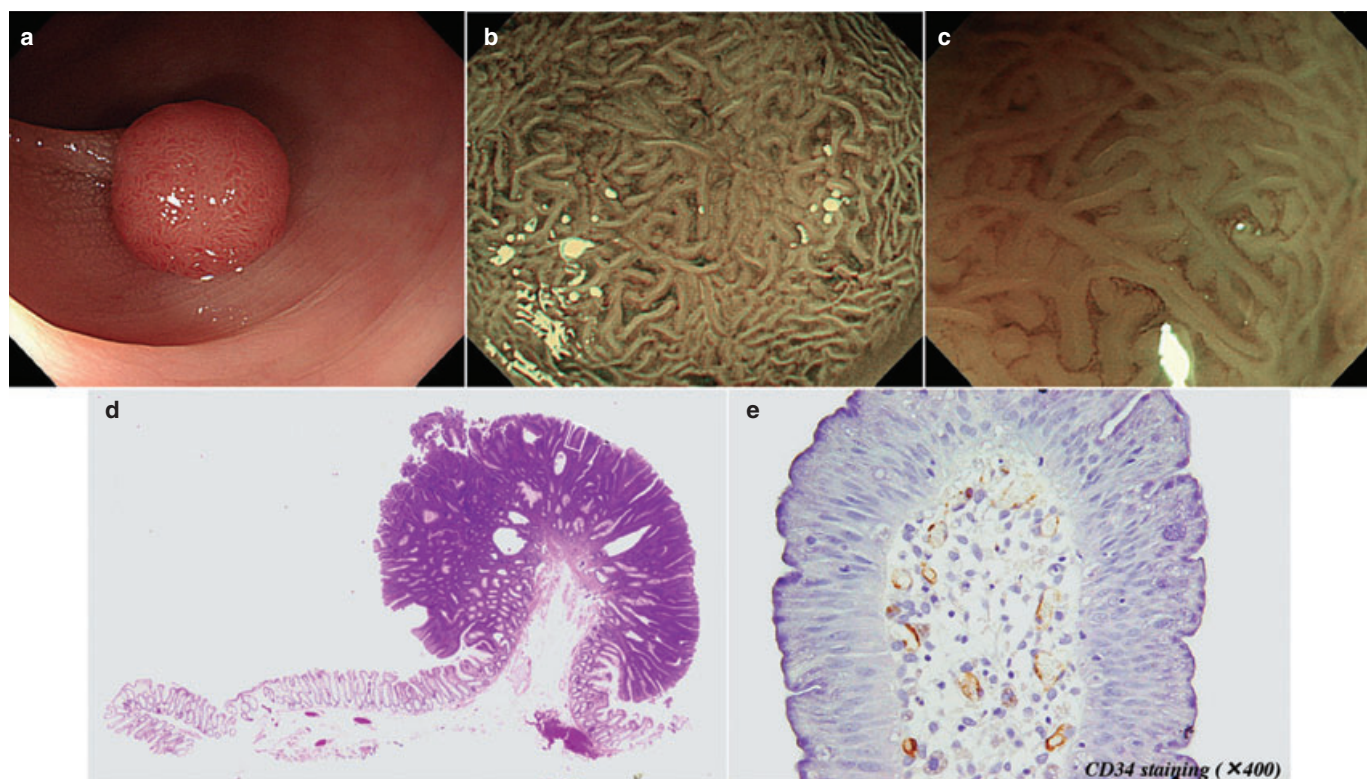
Fig. 2. Case 1: Sessile polypoid lesion 10 mm in diameter. (a) Standard colonoscopic findings. (b) Magnifying view using Narrow Band Imaging (NBI; middle power view). By detecting the microvessels under the standing mucosa among pits, NBI magnification can indirectly detect regular pit structure (regular pit pattern: IIIL). (c) Magnifying view using NBI (high power view). (d) Cross-section of resected specimen (hematoxylin–eosin staining). Histologically, this lesion is tubular adenoma. (e) Immunostaining view for CD34 (× 400). This picture shows microvessels under the standing mucosa among pits.

In this report, the authors assessed the clinical usefulness of magnification using NBI in pit pattern diagnosis for colorectal neoplasia.

NARROW BAND IMAGING MAGNIFICATION

When a lesion was detected by ordinary observation, surface mucus was washed away with lukewarm water. Magnified observation was then performed using NBI and pit pattern diagnosis (classification of Kudo & Tsuruta; Fig. 1)[19] was recorded (Figs 2–4). The magnifying videoendoscope used in this study was a CF-Q260AZI (Olympus Optical Co. Ltd, Tokyo, Japan). The NBI system was provided by the Olympus Optical Co. Ltd. After NBI magnification, lesions were resected endoscopically or surgically.

STEREOSCOPIC EXAMINATION

After each lesion was resected, specimens were fixed in 10% buffered formalin for 12–48 h after extension by pinning on a board. Fixed specimens were rinsed thoroughly and stained for 2–3 min with Carazzi hematoxylin. The pit pattern at the surface of the lesions was observed and photographed with a stereomicroscope. With these photographs, the pit pattern was compared to the magnifying colonoscopic findings using NBI. After examination of the pit pattern, the resected tumor was cut into 2–3 mm blocks. Microscopic examination was performed on hematoxylin–eosin-stained sections by one pathologist unaware of other features of each case. A total of 90 colorectal lesions analyzed in this report include nine cases of hyperplasia, 60 of tubular adenoma and 21 of early carcinoma.

NARROW BAND IMAGING MAGNIFICATION AND PIT PATTERN DIAGNOSIS

The correspondence rate of pit pattern diagnosis between NBI magnification without chromoendoscopy and stereoscopic findings was 100% (9/9) for type II, 100% (56/56) for type IIIL, 100% (3/3) for type IV, 80% (12/15) for type VI, and 57% (4/7) for type VN (Table 1).

DISCUSSION

The rate of correspondence of the regular pit pattern between NBI magnification and stereoscopic examination was 100%. There were no lesions that could not be observed by magnification with NBI. Even if there was thin mucus covering the lesion surface, NBI magnification obtained a good picture through the mucus. By detecting the microvessels under the standing mucosa among pits, NBI magnification can indirectly detect pit structure. In contrast, the rate of correspondence for the VN pit pattern was only 57%, which is low compared with the regular pit pattern.
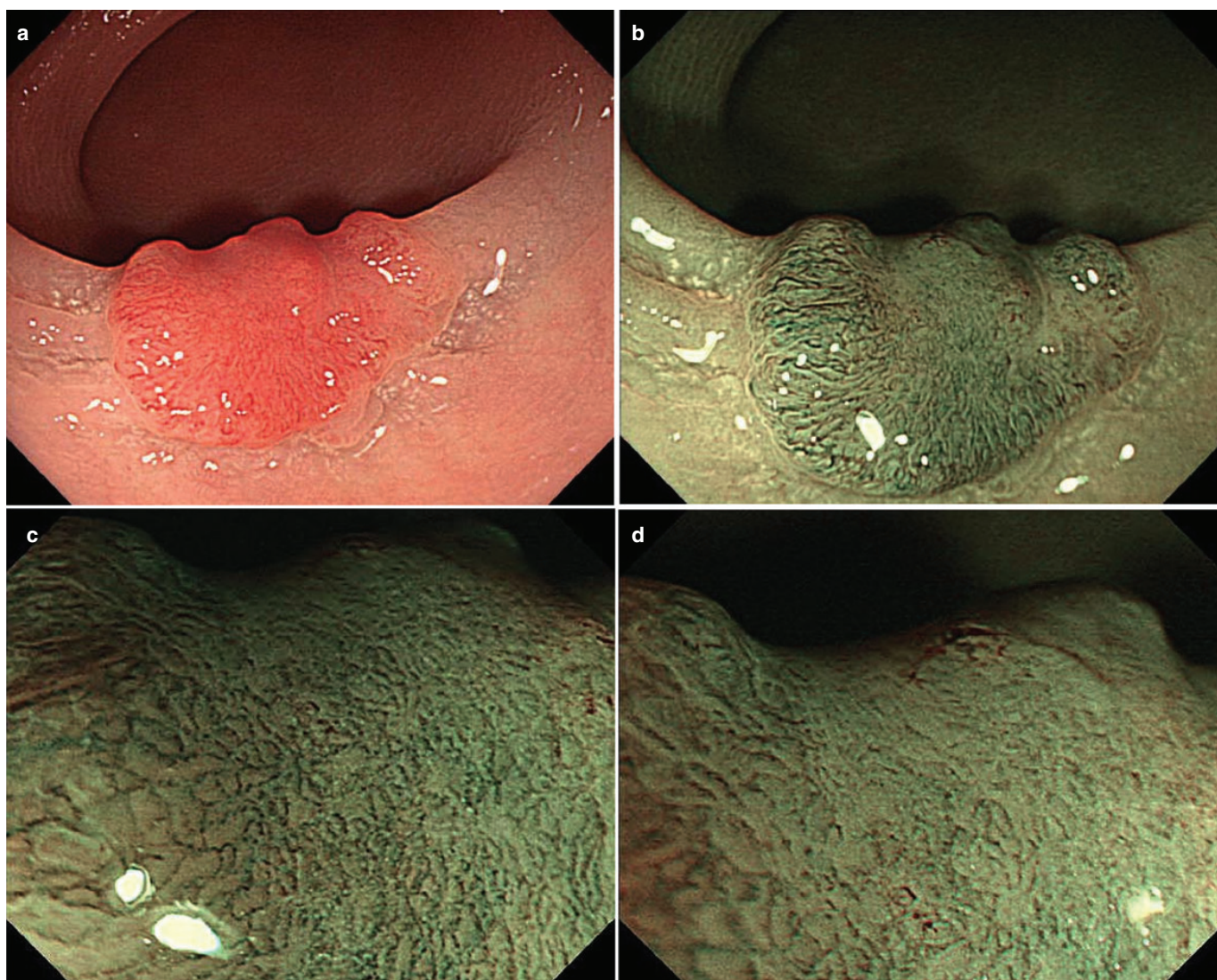
Fig. 3. Case 2: colonoscopic imaging; IIa + IIc type lesion 12 mm in diameter. (a) Standard colonoscopic findings. (b) Standard colonoscopic findings with Narrow Band Imaging (NBI). (c) Magnifying view using NBI (middle power view). (d) Magnifying view using NBI (high power view). This picture shows irregular arrangements of microvessels under the standing mucosa among pits, which indicates irregular pit pattern (VI type pit pattern).

Table 1. Corresponding rate of pit pattern diagnosis

Diagnosis by NBI magnification	Stereoscopic findings					
	II	IIIL	IIIs	IV	VI	VN
II	9 (100)					
IIIL		56 (100)			2 (13)	
IIIs			–			
IV				3 (100)		
VI					12 (80)	3 (43)
VN					1 (7)	4 (57)
Invisible						–
Total	9 (100)	56 (100)	0 (0)	3 (100)	15 (100)	7 (100)

Total accuracy rate of pit pattern diagnosis: 84/90 (93%).
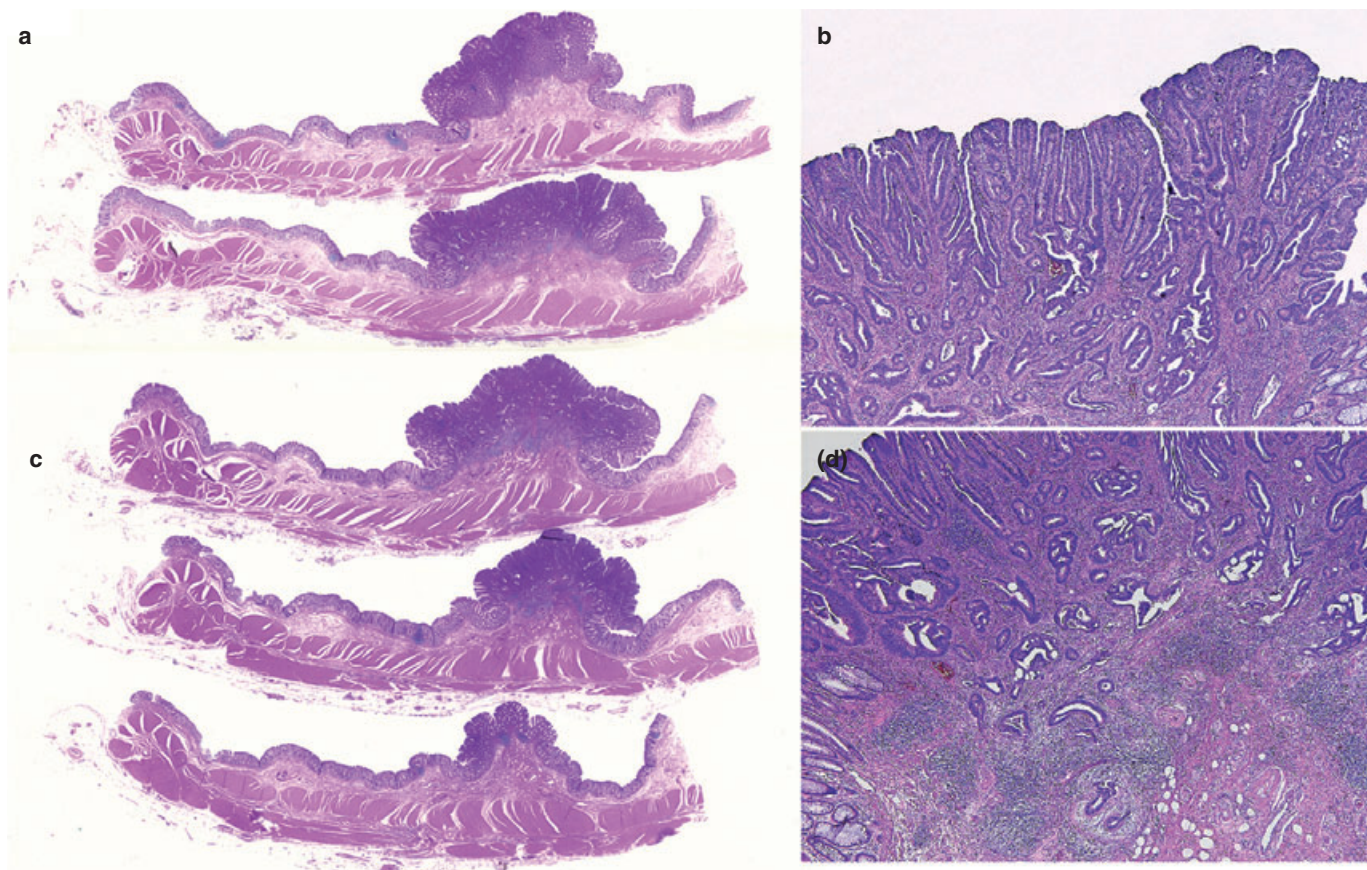NBI, narrow band imaging.

Fig. 4. Case 2: pathology findings; IIa + IIc type lesion 12 mm in diameter. (a) Cross-section of resected specimen (hematoxylin–eosin staining). This lesion shows submucosal massive invasive carcinoma. (b) Histology of the tumor surface (middle power view). (c) Histology of the tumor invasive front (middle power view).

Therefore, while NBI magnification is useful for regular pit pattern diagnosis, it might not be so useful for V_N pit patterns. Lesions with V_N pit pattern do not preserve a superficial pit structure, so NBI magnification could not distinguish between an amorphous state and exudation adhesion. Regarding V_I pit patterns, 80% of lesions were diagnosed precisely, however, in 20% it was difficult to detect the irregular pit pattern; maybe due to the influence of the state of preservation of the pit orifice. Especially, higher grade irregular pit patterns are more difficult to detect by NBI magnification than lower grade irregular ones are.

Generally, angiogenesis is considered to correlate with carcinoma development.[20–22] In the esophageal field it has been reported that intrapapillary capillary loop detected using magnified observation is a useful indicator for invasion depth diagnosis for superficial esophageal carcinoma.[23] As well as for esophageal carcinomas, for diagnosis of V_N pit pattern of early colorectal carcinomas, which is an indicator for massive submucosal invasion, evaluation of the state of superficial microvessel formation will be very important. Further study with an accumulation of various cases will be needed to confirm this point.

Finally, NBI magnification is indeed useful for regular pit pattern (from II to IV) diagnosis of colorectal neoplasia. NBI magnification for V-type pit patterns should be estimated in more detail, especially from the perspective of microangio-logical findings. However, as the NBI method is very easy and does not need chromoendoscopy, it should find widespread acceptance in the near future.

REFERENCES

1. Gono K, Yamasaki K, Doguchi N *et al.* Endoscopic observation of tissue by narrow-band illumination. *Opt. Rev.* 2003; **10**: 1–5.
2. Gono K, Yamaguchi M, Ohyama N *et al.* Improvement of imaging quality of the electroendoscopy by narrowing spectral shapes of observation light. *Proc. Int. Congress Imaging Sci.* 2002; **1**: 399–400.
3. Gono K, Obi T, Yamaguchi M *et al.* Appearance of enhanced tissue features in narrow-band endoscopic imaging. *J. Biomed. Opt.* 2004; **9**: 568–77.
4. Sano Y, Kobayashi M, Hamamoto Y *et al.* New diagnostic method based on color imaging using narrow-band imaging (NBI) system for gastrointentional tract. *Gastrointest. Endosc.* 2001; **53**: AB125.
5. Muto M, Ugumori T, Sano Y *et al.* Narrow-band imaging combined with magnified endoscopy for cancer at the head and neck region. *Dig. Endosc* 2005; **17** (Suppl.): S23–4.
6. Muto M, Nakane M, Katada C *et al.* Squamous cell carcinoma *in situ* at oropharyngeal and hypopharyngeal mucosal sites. *Cancer* 2004; **101**: 1375–81.

7. Hamamoto Y, Endo T, Nosho K *et al.* Usefulness of narrow-band imaging endoscopy for diagnosis of Barrett's esophagus. *J. Gastroenterol.* 2004; **39**: 14–20.

8. Yoshida T, Saito Y, Fu KI. Narrow-Band Imaging system with magnifying endoscopy for superficial esophageal lesions. *Gastrointest. Endosc.* 2004; **59**: 288–95.

9. Sumiyama K, Kaise M, Nakayoshi T. Combined use of a magnifying endoscope with a narrow-band imaging system and a multibending endoscope for en bloc EMR of early stage gastric cancer. *Gastrointest. Endosc.* 2004; **60**: 79–84.

10. Sano Y, Muto M, Tajiri H *et al.* Optical/digital chromoendoscopy during colonoscopy using narrow-band imaging system. *Dig. Endosc.* 2005; **17** (Suppl.): S23–4.

11. Machida H, Sano Y, Hamamoto Y *et al.* Narrow-band imaging in the diagnosis of colorectal mucosal lesions: a pilot study. *Endoscopy* 2004; **36**: 1094–8.

12. Kudo S, Hirota S, Nakajima T *et al.* Colorectal tumor and pit pattern. *J. Clin. Pathol.* 1994; **47**: 880–5.

13. Kudo S, Tamura S, Nakajima S *et al.* Diagnosis of colorectal tumour lesions by magnifying endoscopy. *Gastrointest. Endosc.* 1996; **44**: 8–14.

14. Tsuji Y. Usefulness of magnifying endoscopy for diagnosing tumorous lesions of the colorectum. *Kurume Med. J.* 1998; **45**: 87–94.

15. Tanaka S, Haruma K, Nagata S *et al.* Diagnosis of invasion depth in early colorectal carcinoma by pit pattern analysis with magnifying endoscopy. *Dig. Endosc.* 2001; **13** (Suppl.): S2–5.

16. Tanaka S, Haruma K, Ito M *et al.* Detailed colonoscopy for detecting early superficial carcinoma: recent developments. *J. Gastroenterol.* 2000; **35**: 121–5.

17. Nagata S, Tanaka S, Haruma K *et al.* Pit pattern diagnosis of colorectal carcinoma by magnifying colonoscopy: clinical and histological implications. *Int. J. Oncol.* 2000; **16**: 927–34.

18. Oka S, Tanaka S, Nagata S *et al.* Relationship between histopathological features and type V pit pattern determined by magnifying videocolonoscopy in early colorectal carcinoma. *Dig. Endosc.* 2005; **17**: 117–22.

19. Tanaka S, Yoshida S, Chayama K. Clinical usefulness of high-frequency ultrasound probes for new invasion diagnosis in submucosal colorectal carcinoma. *Dig. Endosc.* 2004; **16** (Suppl.): S161–4.

20. Oh-e H, Tanaka S, Kitadai Y *et al.* Angiogenesis at the site of deepest penetration predicts lymph node metastasis of submucosal colorectal cancer. *Dis. Colon Rectum* 2001; **44**: 1129–36.

21. Tarta C, Teixeira CR, Tanaka S *et al.* Angiogenesis in advanced colorectal adenocarcinoma with special reference to tumoral invasion. *Arq. Gastroenterol.* 2002; **39**: 32–8.

22. Onogawa S, Kitadai Y, Tanaka S *et al.* Expression of VEGF-C and VEGF-D at the invasive edge correlates with lymph node metastasis and prognosis of patients with colorectal carcinoma. *Cancer Sci.* 2004; **95**: 32–9.

23. Kumagai Y, Inoue H, Nagai K *et al.* Magnifying endoscopy, stereoscopic microscopy, and the microvascular architecture of superficial esophageal carcinoma. *Endoscopy* 2002; **34**: 369–75.