

should be conducted in the future to fully evaluate the efficacy of the NBI system for clinical purposes such as screening colonoscopies. Specificity of NBI and HDC also were not indicated because magnification colonoscopies were used and diagnoses based on Kudo's classification of pit pattern analysis in which Type I and II are non-neoplastic lesions. As a result, we were unable to calculate specificity, but considered it to be over 90% based on a previously reported prospective study.³⁸ Finally, all HDC and NBI examinations were performed by highly experienced colonoscopists with extensive training at NCCH. It is uncertain whether other colonoscopists would have achieved the same results, especially those with less experience.

During NBI colonoscopy examinations, intestinal fluid and stool were seen as reddish in color similar to blood¹⁴ so a high-quality bowel preparation was a prerequisite for using NBI and advocating reliable bowel preparation should be an important consideration.

In conclusion, colonoscopic examinations using NBI increased the number of neoplastic lesions detected and improved the detection rate of flat and diminutive lesions in the right colon. The NBI system was used to detect and differentiate neoplastic lesions from non-neoplastic lesions without using any dye or staining solutions. Proper and adequate bowel preparation was essential, however, for maximum NBI detection as well as for better results during HDC examinations. As one of the most technologically advanced optical equipment-based IEE systems, NBI has the potential for becoming a new modality in the future for colorectal screening examinations provided there are further improvements in current limitations, most notably better NBI visualization. If NBI is to meet our optimistic expectations, we should begin a multi-center trial as soon as possible.

References

- Winawer SJ, Zauber AG, Ho MN *et al.* Prevention of colorectal cancer by colonoscopic polypectomy. The National Polyp Study Workgroup. *N. Engl. J. Med.* 1993; **329**: 1977-81.
- Niv Y, Dickman R, Figer A *et al.* Case-control study of screening colonoscopy in relatives of patients with colorectal cancer. *Am. J. Gastroenterol.* 2003; **98**: 486-9.
- Citarda F, Tomaselli G, Capocaccia R *et al.* Efficacy in standard clinical practice of colonoscopic polypectomy in reducing colorectal cancer incidence. *Gut* 2001; **48**: 812-15.
- Rockey DC, Paulson E, Niedzwiecki D *et al.* Analysis of air contrast barium enema, computed tomographic colonography, and colonoscopy: prospective comparison. *Lancet* 2005; **365**: 305-11.
- Rex DK, Cutler CS, Lemmel GT *et al.* Colonoscopic miss rates of adenomas determined by back-to-back colonoscopies. *Gastroenterology* 1997; **112**: 24-8.
- Hixson LJ, Fenerty MB, Sampliner RE, Garewal HS. Prospective blinded trial of the colonoscopic miss-rate of large colorectal polyps. *Gastrointest. Endosc.* 1991; **37**: 125-7.
- Rembacken BJ, Fujii T, Cairns A *et al.* Flat and depressed colonic neoplasms: a prospective study of 1000 colonoscopies in the UK. *Lancet* 2000; **355**: 1211-14.
- Tsuda S, Veress B, Toth E *et al.* Flat and depressed colorectal tumours in a southern Swedish population: a prospective chromoendoscopic and histopathological study. *Gut* 2002; **51**: 550-5.
- Saitoh Y, Waxman I, West AB *et al.* Prevalence and distinctive biologic features of flat colorectal adenomas in a North American population. *Gastroenterology* 2001; **120**: 1657-65.
- Kudo S, Kashida H, Tamura T *et al.* Colonoscopic diagnosis and management of nonpolypoid early colorectal cancer. *World J. Surg.* 2000; **24**: 1081-90.
- Hurlstone DP, Cross SS, Adam I *et al.* A prospective clinicopathological and endoscopic evaluation of flat and depressed colorectal lesions in the United Kingdom. *Am. J. Gastroenterol.* 2003; **98**: 2543-9.
- 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.
- Sano Y, Kobayashi M, Hamamoto Y *et al.* New diagnostic method based on color imaging using narrow band imaging (NBI) system for gastrointestinal tract. *Gastrointest. Endosc.* 2001; **53**: AB125.
- Sano Y, Muto M, Tajiri H, Ohtsu A, Yoshida S. Optical/digital chromoendoscopy during colonoscopy using narrow-band image system. *Dig. Endosc.* 2005; **17**: S43-8.
- 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.
- Sano Y, Horimatsu T, Fu KI, Katagiri A, Muto M, Ishikawa H. Magnifying observation of microvascular architecture of colorectal lesions using a narrow-band imaging system. *Dig. Endosc.* 2006; **18**: S44-51.
- Sumiyama K, Kaise M, Nakayoshi T *et al.* 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.
- Kara MA, Peters FP, Rosmolen WD *et al.* High-resolution endoscopy plus chromoendoscopy or narrow-band imaging in Barrett's esophagus: a prospective randomized crossover study. *Endoscopy* 2005; **37**: 929-36.
- Sharma P, Bansal A, Mathur S *et al.* The utility of a novel narrow band imaging endoscopy system in patients with Barrett's esophagus. *Gastrointest. Endosc.* 2006; **64**: 167-75.
- Yoshida T, Inoue H, Usui S *et al.* Narrow-band imaging system with magnifying endoscopy for superficial esophageal lesions. *Gastrointest. Endosc.* 2004; **59**: 288-95.
- Kaltenbach T, Sano Y, Friedland S, Soetikno R; American Gastroenterological Association. American Gastroenterological Association (AGA) Institute technology assessment on image-enhanced endoscopy. *Gastroenterology* 2008; **134**: 327-40.
- Muto M, Nakane M, Katada C *et al.* Squamous cell carcinoma in situ at oropharyngeal and hypopharyngeal mucosal sites. *Cancer* 2004; **101**: 1375-81.
- Shibuya K, Hoshino H, Chiyo M *et al.* High magnification bronchovideoscopy combined with narrow band imaging could detect capillary loops of angiogenic squamous dysplasia in heavy smokers at high risk for lung cancer. *Thorax* 2003; **58**: 989-95.
- Rastogi A, Bansal A, Wani S *et al.* Narrow-band imaging colonoscopy—a pilot feasibility study for the detection of polyps and correlation of surface patterns with polyp histologic diagnosis. *Gastrointest. Endosc.* 2008; **67**: 280-6.
- East JE, Suzuki N, Stavrinidis M, Guenther T, Thomas HJ, Saunders BP. Narrow band imaging for colonoscopic surveillance in hereditary non-polyposis colorectal cancer. *Gut* 2008; **57**: 65-70.
- Hamashima C, Sobue T, Muramatsu Y, Saito H, Moriyama N, Kakizoe T. Comparison of observed and expected numbers

- of detected cancers in the research center for cancer prevention and screening program. *Jpn. J. Clin. Oncol.* 2006; **6**: 301–8.
- 27 Kudo S, Tamura S, Nakajima T, Yamano H, Kosaka H, Watanabe H. Diagnosis of colorectal tumorous lesions by magnifying endoscopy. *Gastrointest. Endosc.* 1996; **44**: 8–14.
- 28 Fujii T, Hasegawa RT, Saitoh Y *et al.* Chromoscopy during colonoscopy. *Endoscopy* 2001; **33**: 1036–41.
- 29 Jorgensen OD, Kronborg O, Fenger C. The Funen Adenoma Follow-up Study. Incidence and death from colorectal carcinoma in an adenoma surveillance program. *Scand. J. Gastroenterol.* 1993; **28**: 869–74.
- 30 Woolfson IK, Eckholdt GJ, Wetzel CR *et al.* Usefulness of performing colonoscopy one year after endoscopic polypectomy. *Dis. Colon Rectum* 1990; **33**: 389–93.
- 31 Atkin WS, Morson BC, Cuzick J. Long-term risk of colorectal cancer after excision of rectosigmoid adenomas. *N. Engl. J. Med.* 1992; **326**: 658–62.
- 32 Bond JH. Clinical relevance of the small colorectal polyp. *Endoscopy* 2001; **33**: 454–7.
- 33 Lynch HT, de la Chapelle A. Hereditary colorectal cancer. *N. Engl. J. Med.* 2003; **348**: 919–32.
- 34 Watanabe T, Muto T, Sawada T, Miyaki M. Flat adenoma as a precursor of colorectal carcinoma in hereditary nonpolyposis colorectal carcinoma. *Cancer* 1996; **77**: 627–34.
- 35 Skinner SA, Frydman GM, O'Brien PE. Microvascular structure of benign and malignant tumors of the colon in humans. *Dig. Dis. Sci.* 1995; **40**: 373–84.
- 36 Brooker JC, Saunders BP, Shah SG *et al.* Total colonic dye-spray increases the detection of diminutive adenomas during routine colonoscopy: a randomized controlled trial. *Gastrointest. Endosc.* 2002; **56**: 333–8.
- 37 Hurlstone DP, Cross SS, Slater D, Slater R, Sanders DS, Brown S. Detecting diminutive colorectal lesions at colonoscopy: a randomized controlled trial of pan-colonic versus targeted chromoscopy. *Gut* 2004; **53**: 376–80.
- 38 Fu KI, Sano Y, Kato S *et al.* Chromoendoscopy using indigo carmine dye spraying with magnifying observation is the most reliable method for differential diagnosis between non-neoplastic and neoplastic colorectal lesions: a prospective study. *Endoscopy* 2004; **36**: 1089–93.