

## Insights into endoscopic imaging

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Unarguably, the evolution of optical imaging technologies during the last decades has had a significant impact on the field of endoscopy. Conventional white-light colonoscopy has revealed a limited accuracy (59-84%) in differentiating neoplastic from non-neoplastic polyps [1-3]. Conversely, the optical diagnosis *in vivo*, at the time of endoscopy, is deemed to be an attractive approach for physicians, patients and health providers. With the advent of Narrow Band Imaging (NBI) and Chromo-Endoscopy (CE), new perspectives for the characterization of polyp features have emerged aiming at a more accurate diagnosis. Of importance, these modalities can be combined with high-resolution and/or magnification endoscopy (ME) to improve optical outcomes [3,4]. However, their wide routine use requires provision of appropriate evidence demonstrating their benefit and cost-efficacy and physician's education, familiarity and competence.

Targeting the vascular and crypt pattern is the key element of the optical diagnosis. NBI (Olympus, Japan) [5] comprises short wavelength and narrow-bandwidth "blue light", delivered at the push of a button on the endoscope head. It mainly allows assessment of microvascular density via vascular pattern intensity [6] and meshed brown-capillary network [7] giving a darker appearance of the adenomas secondary to increased angiogenesis. Additionally, NBI microvessel-based classification has a short learning curve that supports early adoption in particular at academic centers [8]. On the other hand, the magnification chromo-endoscopy (MC) is a combination of dye application, such as indigo carmine, plus high-resolution optical magnification. With the aid of this sophisticated technology, MC provides precise pit pattern recognition and enhancement of mucosal surface analysis (92-98%), and is described as a non-biopsy technique for differential diagnosis of non-neoplastic and neoplastic lesions [9]. However, previous studies had failed to show significant improvement in detection of adenomas or hyperplastic polyps when using high-definition instruments [10]. Other reported drawbacks

to MC are the time and training needed to achieve expertise [11]. Nevertheless, both NBI and CE could be opted for clinical practice and their selective application in specific clinical conditions is already in use and is officially recommended [12].

Kudo *et al* delved into the polyp morphology and decoded the crypt pattern by introducing the first pit pattern classification [13]. Based on this innovative concept, other investigatory groups with expertise in the optical diagnosis demonstrated a different evaluation of mucosal surface analysis [14,15]. To anticipate the complexity and to standardize the NBI observation criteria, an international cooperative group (Colon Tumor NBI Interest Group - CTNIG) has recently developed a simple NBI magnifying observation classification (NICE classification: NBI International Colorectal Endoscopic Classification) which classifies NBI into types 1-3 [16].

Dr Yao *et al* have recently proposed a systematic but simple classification system based on microvascular (MV) pattern and microsurface (MS) pattern ('VS' classification system) using NBI with ME to visualize the morphology of gastric mucosal capillaries [17]. The main listed indications were: 1) routine screening endoscopy: distinguishing between small early gastric cancer and focal gastritis; and 2) the preoperative assessment of the lateral extent of early gastric cancer, for curative endoscopic resection. As such, ME with NBI appeared to be a reliable imaging technique for the characterization and delineation of early gastric cancer.

In another study, Dr Hisabe and colleagues present a prospective feasibility and validity study to evaluate the usefulness of the same VS classification system in differentiating neoplastic from non-neoplastic polyps in colon [18]. The comparison of VS classification system (using ME with NBI) with pit pattern analysis (using MC), performed by two experienced endoscopists (moderate inter-observational agreement), revealed an almost equivalent diagnostic performance in adenoma and cancer. Despite the disparity between MV and MS in limited cases and the small number of patients with deep submucosal invasion (SMd) and intramucosal carcinoma with superficial submucosal invasion (M/SMs), the preliminary results were promising. The authors demonstrated the potential usefulness of VS classification in the colon as an alternative comprehensive diagnostic tool to the established pit pattern analysis. However, further longitudinal clinical studies are mandatory to define the role of the VS classification system in the clinical decision-making process for the management of colorectal neoplasia.

To date, optical imaging modalities (NBI and CE) are routinely used in most tertiary academic centers to facilitate on-site differentiation of neoplastic from non-neoplastic lesions and early detection of sub-minimal recurrence or

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residual polyp tissue on the scar of previous complex colon polypectomies. A new perspective of these optical tools was initially suggested by a prospective (DISCARD) trial where optical diagnosis (high-definition white light and non-magnified NBI) at colonoscopy showed to be feasible for the accurate characterization of polyps smaller than 10 mm. An overall accuracy of 93% with optical diagnosis, using high confidence, was similar to the overall diagnostic yield for standard histopathology [19]. To support the incorporation of these endoscopic technologies into the clinical practice, new paradigms were recently published by the American Society for Gastrointestinal Endoscopy PIVI (Preservation and Incorporation of Valuable Endoscopic Innovations). This PIVI initiative was developed to assist in the colonoscopic management of diminutive ( $\leq 5$  mm in size) colorectal polyps, to reduce costs ('resect and discard'), to improve patient safety and eliminate the delay in recommending the next surveillance [20].

In conclusion, we strongly recommend that centers with a high volume of endoscopic procedures should be familiarized with optical imaging technology to improve accuracy and efficacy of diagnostic and therapeutic outcomes.

## References

- Machida H, Sano Y, Hamamoto Y, et al. Narrow-band imaging in the diagnosis of colorectal mucosal lesions: a pilot study. *Endoscopy* 2004;**36**:1094-1098.
- Apel D, Jakobs R, Schilling D, et al. Accuracy of high resolution of chromoendoscopy in prediction of histologic findings in diminutive lesions of the rectosigmoid. *Gastrointest Endosc* 2006;**63**:824-828.
- Tischendorf JJ, Wasmuth HE, Koch A, et al. Value of magnifying chromoendoscopy and narrow band imaging (NBI) in classifying colorectal polyps: a prospective controlled study. *Endoscopy* 2007;**39**:1092-1096.
- East JE, Suzuki N, Bassett P, et al. Narrow band imaging with magnification for the characterization of small and diminutive colonic polyps: pit pattern and vascular pattern intensity. *Endoscopy* 2008;**40**:811-817.
- Song LM, Adler DG, Conway JD, et al. Narrow band imaging and multiband imaging. *Gastrointest Endosc* 2008;**67**:581-589.
- East JE, Suzuki N, Saunders BP. Comparison of magnified pit pattern interpretation with narrow band imaging versus chromoendoscopy for diminutive colonic polyps: a pilot study. *Gastrointest Endosc* 2007;**66**:310-316.
- Sano Y, Ikematsu H, Fu KI, et al. Meshed capillary vessels by use of narrow-band imaging for differential diagnosis of small colorectal polyps. *Gastrointest Endosc* 2008;**69**:278-283.
- Rogart JN, Jain D, Siddiqui UD, et al. Narrow-band imaging without high magnification to differentiate polyps during real-time colonoscopy: improvement with experience. *Gastrointest Endosc* 2008;**68**:1136-1145.
- Kato S, Fu KI, Sano Y, et al. Magnifying colonoscopy as non-biopsy technique for differential diagnosis of non-neoplastic and neoplastic lesions. *World J Gastroenterol* 2006;**12**:1416-1420.
- Pellise M, Fernandez-Esparrach G, Cardenas A, et al. Impact of wide-angle, high-definition endoscopy in the diagnosis of colorectal neoplasia: a randomized controlled trial. *Gastroenterology* 2008;**13**:1062-1068.
- Togashi K, Konishi F. Magnification chromo-colonoscopy. *ANZ J Surg* 2006;**76**: 1101-1105.
- Suzuki N, Saunders BP, Brown G. Flat colorectal neoplasms: endoscopic detection, clinical relevance and management. *Tech Coloproctol* 2004;**8** (Suppl 2):s261-s266.
- Kudo S, Tamura S, Nakajima T, et al. Diagnosis of colorectal tumorous lesions by magnifying endoscopy. *Gastrointest Endosc* 1996;**44**:8-14.
- Uraoka T, Saito Y, Ikematsu H, et al. Sano's capillary pattern classification for narrow-band imaging of early colorectal lesions. *Dig Endosc* 2011;**23** (Suppl 1):112-115.
- Oka S, Tanaka S, Takata S, et al. Clinical usefulness of narrow band imaging magnifying classification for colorectal tumors based on both surface pattern and microvessel features. *Dig Endosc* 2011;**23** (Suppl 1):101-105.
- Tanaka S, Sano Y. Aim to unify the narrow band imaging (NBI) magnifying classification for colorectal tumors: current status in Japan from a summary of the consensus symposium in the 79th Annual Meeting of the Japan Gastroenterological Endoscopy Society. *Dig Endosc* 2011;**23** (Suppl 1):131-139.
- Yao K, Anagnostopoulos GK, Ragunath K. Magnifying endoscopy for diagnosing and delineating early gastric cancer. *Endoscopy* 2009;**41**:462-467.
- Hisabe T, Yao K, Beppu T, et al. Validity of the usefulness of microvascular architecture and microsurface structure using magnifying endoscopy with narrow-band imaging in the colorectal neoplasm. *Ann Gastroenterol* 2013;**26**:46-52.
- Ignjatovic A, East JE, Suzuki N, et al. Optical diagnosis of small colorectal polyps at routine colonoscopy (Detect InSpect Characterise Resect and Discard; DISCARD trial): a prospective cohort study. *Lancet Oncol* 2009;**10**:1171-1178.
- Rex DK, Kahi C, O'Brien M, et al. The American Society for Gastrointestinal Endoscopy PIVI (Preservation and Incorporation of Valuable Endoscopic Innovations) on real-time endoscopic assessment of the histology of diminutive colorectal polyps. *Gastrointest Endosc* 2011;**73**:419-422.