Systematic Review/Meta Analysis

Comparison of Diagnostic Efficacy Between AFI, NBI, and AFI Combined with NBI for Colonic Cancers: A Meta-Analysis

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ABSTRACT

Background/Aims: Advanced endoscopic imaging technologies have been used for the early detection and differentiation of colonic cancers recently. We aim to evaluate the diagnostic efficacy of autofluorescence imaging (AFI), narrow-band imaging (NBI), and AFI combined with NBI for colonic cancers.

Materials and Methods: We searched Medline/PubMed, Embase, Web of Science, and Cochrane Library databases for relevant articles. A random-effects model was used to assess diagnostic efficacy. Heterogeneity was tested by the $I^2$ statistic and Chi-square test. Meta-regression was used to analyze the sources of heterogeneity. Results: The pooled sensitivities for AFI, NBI, and AFI plus NBI were 0.84 (95% confidence interval (CI) 0.82–0.87), 0.84 (95% CI 0.81–0.86), and 0.93 (95% CI 0.90–0.95), respectively. The pooled specificities were 0.44 (95% CI 0.40–0.48), 0.69 (95% CI 0.65–0.72), and 0.69 (95% CI 0.64–0.74), respectively. The sensitivity estimate was significantly higher for AFI plus NBI than AFI or NBI alone ($P = 0.041$), and the specificity estimates were significantly higher for NBI and AFI plus NBI than AFI ($P = 0.031$). The pooled diagnostic odds ratio for AFI, NBI, and AFI plus NBI were 8.71 (95% CI 2.90–26.16), 16.02 (95% CI 7.05–36.39), and 57.55 (95% CI 9.82–337.33), respectively. Furthermore, the summary receiver operating characteristic curve area under the curve for AFI, NBI, and AFI plus NBI were 0.8125 with $Q^* = 0.7469$, 0.8696 with $Q^* = 0.8001$, and 0.9447 with $Q^* = 0.8835$, respectively. The $Q^*$ index for AFI plus NBI was significantly higher than AFI or NBI alone ($P = 0.048$).

Conclusion: The combination of AFI and NBI was associated with increased diagnostic value for colonic cancers compared with AFI and NBI alone.

Key Words: Autofluorescence imaging, colonic cancer, colonoscopy, narrow band imaging

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The aim of screening colonoscopy is to prevent the development of colonic cancer by means of colonoscopic detection and polyp resection. However, some specific lesions may be missed (such as small or flat adenomas) or difficult to detect (such as depressed-type colorectal tumors and nongranular-type laterally spreading tumors) during conventional colonoscopy examinations;[1] Removal of non-neoplastic polyps with standard white light colonoscopy (WLC) occurs occasionally, and such inappropriate polyp resection may lead to unnecessary risks of perforation or bleeding.[2] Advanced endoscopic imaging technologies are needed to assist endoscopists in dealing with these problems.

In recent years, several clinical trials have shown that chromoendoscopy (CE) could increase the detection rate of colonic neoplasia.[3,4] However, this procedure is labor-intensive, time-consuming, and requires special training. Narrow-band imaging (NBI) is a novel imaging technique that uses special narrow-band filters to highlight mucosal and vascular details of the gastrointestinal tract. It has been demonstrated to improve the detection of colonic lesions and to help distinguish adenoma from hyperplastic polyps.[5,6] Autofluorescence imaging (AFI) is another imaging technique that can be employed to polyp detection.
It can be used for differentiation based on the differences of emitted autofluorescent light between neoplastic and non-neoplastic polyps. Several studies have attempted to assess the diagnostic performance of AFI and NBI for colonic neoplasms, but the results of these studies are heterogeneous. On the other hand, the appearance of endoscopic trimodal imaging (ETMI), which integrates AFI, NBI, and high-resolution endoscopy (HRE) into one system, brings about the possibility to combine AFI and NBI conventionally in the future. Therefore, we performed this meta-analysis to assess the diagnostic efficacy of AFI, NBI, and AFI combined with NBI for colonic neoplasms.

MATERIALS AND METHODS

This study did not require any ethical approval and informed consent because only published material was included.

Literature search
A systematic literature search was conducted to identify relevant studies which compared the diagnostic value of AFI, NBI, and AFI combined with NBI in the diagnosis of colonic neoplasms. We searched Medline/PubMed, Embase, Web of science, and Cochrane Library databases for articles that were published in English up to 30th September, 2015. The following search terms were used: “autofluorescence imaging,” “AFI,” “narrow band imaging,” “NBI,” “colonic neoplasm,” “colon neoplasm,” “colonic cancer,” and “colon cancer.” The references in the available studies and abstracts from important GI meetings, such as Digestive Disease Week and Asian Pacific Digestive Week, were also reviewed systematically. Two investigators independently reviewed each publication for applicable studies. Disagreements were settled by a discussion with a third investigator.

Inclusion and exclusion criteria
Inclusion criteria include the following: (1) diagnostic clinical trials that used AFI and NBI to differentiate colonic neoplastic lesions from non-neoplastic lesions; (2) diagnostic efficacies of AFI and NBI compared in the references; (3) inclusion of more than 20 lesions; (4) use of histopathologic analysis as the reference standard (gold standard) for the diagnosis of lesions; (5) absolute numbers of true positive (TP), false positive (FP), true negative (TN), and false negative (FN) cases were provided or could be calculated from primary data; and (6) latest reported article was chosen if the same study was repeatedly reported.

Exclusion criteria include the following: (1) patients without colonic lesions but with other gastrointestinal lesions, or diagnosis of colonic neoplasms with other existing disease that could not be differentiated; (2) data or subsets of data without pathological confirmation of lesions, or were reported in duplicate in similar studies, and (3) publication types as reviews, case reports, editorials, comments, and letters.

We did not attempt to contact the authors for unpublished data or to locate unpublished material.

Data extraction
The following data were extracted from each report: first author’s name, year of publication, country of origin, number of patients and lesions, age and sex of participants, diagnostic classifications for AFI and NBI, study design, reference standard. The numbers of TP, FP, TN, and FN were also extracted for the construction of 2 × 2 contingency tables. All data were extracted by two investigators independently.

Quality assessment
The quality of diagnostic accuracy studies (QUADAS) tool was used to assess the quality of selected studies. QUADAS is a validated clinometric tool used to assess the overall quality of diagnostic accuracy studies through individual quality component questions. Each of the 14 items in the QUADAS checklist was scored as “Yes,” “No,” or “Unclear.” Each item was scored “Yes” if reported, “No” if not reported, or “Unclear” if sufficient information was not available to make an accurate decision.

Statistical analysis
The possibility of a threshold effect was first tested by calculating the Spearman correlation coefficient for the included studies. We calculated the pooled sensitivity, specificity, and diagnostic odds ratio (DOR) for each modality by using a random effects model to derive estimates and 95% confidence intervals (CIs) if the evidence of a threshold effect was not found. In this case, the summary receiver operating characteristic curves (SROC) and the Q index were also calculated. The SROC area under the curve (AUC) and integrated DOR value were used to analyze the diagnostic efficacy of each modality if the evidence of a threshold effect was found. The Z test was performed to determine statistical differences between sensitivity, specificity, DOR, and Q index of different modalities. The F statistic and Chi-square test were used to detect statistically significant heterogeneity. All P values less than 0.05 were considered to indicate heterogeneity between studies. Meta-DiSc (version 1.4, XI Cochrane Colloquium, Barcelona, Spain) and STATA (version 11.0, College Station, TX) software were used for data analyses in this study.

RESULTS

Search results and study description
A total of 948 primary studies were identified for literature screening [Figure 1]. From these studies, 210 were excluded.
as duplicates and 723 were excluded after reviewing the titles and abstracts. After a review of the full-texts, the reasons for the final study exclusion were as follows: (1) insufficient data were reported to calculate TP, FP, TN, and FN (N = 2);\(^{[12,13]}\) (2) different evaluation methods for diagnostic efficacy were used (N = 2);\(^{[1,14]}\) (3) suspicious data duplications appeared in similar studies (N = 3).\(^{[15‑17]}\) Finally, 8 studies were included in our analysis, comprising a total of 660 patients and 1426 lesions. All of them were prospective studies.\(^{[18‑25]}\) Table 1 shows the principal characteristics of the studies included in the meta-analysis.

**Quality assessment**

Detailed information regarding the quality of eligible studies is shown in Table 2. The items 4, 10, 11, and 13 were scored “unclear” for the studies published by Probst et al. and Goelder et al. because relevant information could not be extracted from existing data. In addition to these two meeting abstracts, the other selected studies achieved most of the quality items, suggesting a good quality of included studies. Not all samples received verification by using a reference standard of diagnosis for the results published by Van den Broek et al., Kuiper et al., and Sato et al., hence item 5 was scored “no” in these 3 studies. Furthermore, as the reasons for such exclusions were not explained, item 13 was scored “no” in these 2 studies published by Kuiper et al. and Sato et al.

**Analysis results**

Spearman correlation coefficients for AFI, NBI, and AFI plus NBI were 0.870 (P = 0.349), 0.381 (P = 0.352), and 0.400 (P = 0.600), respectively. These results indicated the lack of a definite threshold effect-induced heterogeneity of different modalities. When a random effects model was used, the pooled sensitivities for AFI, NBI, and AFI plus NBI were 0.84 (95% CI 0.82–0.87), 0.84 (95% CI 0.81–0.86), and 0.93 (95% CI 0.90–0.95), respectively. The pooled specificities were 0.44 (95% CI 0.42–0.47).

**Table 1: Characteristics of the studies selected for the meta-analysis**

| Study (year)     | Country     | Patients | Lesions | Sex (M/F) | Mean age | Diagnostic classification for AFI | Diagnostic classification for NBI | Reference standard | Study design   | Restrictions |
|------------------|-------------|----------|---------|-----------|----------|----------------------------------|----------------------------------|-------------------|---------------|--------------|
| Probst et al. (2006) | Germany    | 19       | 24      | NS        | NS       | Green-purple-ambiguous            | Kudo pit-pattern                   | NS                | Prospective None | None         |
| Goelder et al. (2007) | Germany    | 19       | 51      | NS        | NS       | Green-purple-ambiguous            | Kudo pit-pattern                   | NS                | Prospective None | None         |
| Vanden Broek et al. (2008) | Netherlands | 50      | 98      | 31/19     | 50.5     | Green-purple-ambiguous            | Kudo pit-pattern                   | Vienna criteria    | Prospective UC   | UC           |
| Boparai et al. (2009) | Netherlands | 7       | 66      | 5/2       | 55.8     | Green-purple-ambiguous            | Kudo pit-pattern                   | WHO guidelines     | Prospective HPS  | HPS          |
| Vanden Broek et al. (2009) | Netherlands | 100    | 208     | 43/57     | 52       | Green-purple-ambiguous            | Kudo pit-pattern                   | Vienna criteria    | Prospective None | None         |
| Ignjatovic et al. (2011) | Britain    | 48      | 80      | 30/18     | 64.7     | Green-purple-ambiguous            | Kudo pit-pattern                   | WHO guidelines     | Prospective SCP  | None         |
| Kuiper et al. (2011) | Netherlands | 234    | 256     | 128/106   | 59       | Green-purple-ambiguous            | Kudo pit-pattern                   | Vienna criteria    | Prospective None | None         |
| Sato et al. (2011) | Japan       | 183     | 424     | 128/55    | 64.9     | Green-purple                       | Sano pattern                       | Vienna criteria    | Prospective None | None         |

NS, not stated. Green-purple-ambiguous, green was considered non-neoplastic and purple or ambiguous colors were considered neoplastic. Green-purple, green or green with purple spots group were considered non-neoplastic and purple with green spots or purple group were considered neoplastic. Kudo pit-pattern, the classification was proposed by Kudo et al., Sano pattern, the classification was proposed by Sano et al., UC, ulcerative colitis; HPS, hyperplastic polyposis syndrome; SCP, small colonic polyp (≤10 mm); None, the study was conducted without following specific requirements.
CI 0.40–0.48), 0.69 (95% CI 0.65–0.72), and 0.69 (95% CI 0.64–0.74), respectively. The sensitivity estimate was significantly higher for AFI plus NBI than AFI or NBI alone (P = 0.041), and the specificity estimates were significantly higher for NBI and AFI plus NBI than AFI (P = 0.051). The pooled estimates were not different between AFI and NBI for sensitivity, or NBI and AFI plus NBI for specificity. The forest plots for the sensitivity and specificity of AFI, NBI, and AFI plus NBI are shown in Figures 2-4.

The pooled DOR for AFI was 8.71 (95% CI 2.90–26.16), and the Cochran’s Q and I² were 64.71 (P = 0.0001) and 89.2%, respectively. The pooled DOR for NBI was 16.02 (95% CI 7.05–36.39), and the Cochran’s Q and I² were 37.83 (P = 0.0001) and 81.5%, respectively. The DOR for AFI plus NBI was 57.55 (95% CI 9.82–337.33), and the Cochran’s Q and I² were 18.88 (P = 0.0003) and 84.1%, respectively. The DOR estimate for AFI plus NBI was significantly higher than AFI or NBI alone (P = 0.038). Furthermore, The AUCs for AFI, NBI, and AFI plus NBI were 0.8125 (Standard error (SE) = 0.0597) with Q* = 0.7469 (SE = 0.0531), 0.8696 (SE = 0.0340) with Q* = 0.8001 (SE = 0.0353) and 0.9447 (SE = 0.0357) with Q* = 0.8535 (SE = 0.0464), respectively. The Q* index for AFI plus NBI was significantly higher than AFI or NBI alone (P = 0.048). All these data indicated higher diagnostic accuracy for AFI plus NBI compared to AFI or NBI alone. These results can be seen from Figure 5.

### Heterogeneity exploration

Significant heterogeneities were found in the sensitivity, specificity, and DOR estimate of different modalities, which can be seen from Figures 2-5. Thus, sensitivity analysis was performed first according to the inclusion criteria of different studies [Table 3]. We included 6 studies after exclusion of 2 studies as abstracts, and 7 studies after the exclusion of

| Item 1 | Item 2 | Item 3 | Item 4 | Item 5 | Item 6 | Item 7 | Item 8 | Item 9 | Item 10 | Item 11 | Item 12 | Item 13 | Item 14 | Score |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Probst et al. (2006) | Y | Y | Y | U | Y | Y | Y | Y | U | U | U | Y | Y | 10 |
| Goelder et al. (2007) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10 |
| Vanden Broek et al. (2008) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 14 |
| Boparai et al. (2009) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 14 |
| Vanden Broek et al. (2009) | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | 13 |
| Ignjatovic et al. (2011) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 14 |
| Kuiper et al. (2011) | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | N | Y | Y | 12 |
| Sato et al. (2011) | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | N | Y | 12 |

Y, Yes; N, no; U, unclear. 1. Was the spectrum of patients representative of the patients who will receive the test in practice? 2. Were selection criteria clearly described? 3. Is the reference standard likely to correctly classify the target condition? 4. Is the time period between reference standard and index test short enough to be reasonably sure that target condition did not change between two tests? 5. Did the whole sample or a random selection of the sample receive verification using a reference standard? 6. Did patients receive the same reference standard regardless of the index test result? 7. Was the reference standard independent of the index test (i.e., the index test did not form part of the reference standard)? 8. Was the execution of the index test described in sufficient detail to permit replication of the test? 9. Was the execution of the reference standard described in sufficient detail to permit its replication? 10. Were the index test results interpreted without knowledge of the results of the reference standard? 11. Was the reference standard results interpreted without knowledge of the results of the index test? 12. Were the same clinical data available when test results were interpreted as would be available when the test is used in practice? 13. Were uninterpretable/intermediate test results reported? 14. Were withdrawals from the study explained?

Figure 2: Analysis of the diagnostic efficacy results of AFI. (a) Pooled sensitivity of AFI for diagnosing colonic cancers. (b) Pooled specificity of AFI for diagnosing colonic cancers.
study from Japan. The results showed that the diagnostic efficacy of AFI or NBI for colonic cancers was similar to the originally pooled measures, which implies that the stability of the study results was good. However, heterogeneity was still significant among the studies. Therefore, a meta-regression analysis was conducted subsequently to explore the possible sources of heterogeneity. Specific variables assessed were as follows: number of patients (<50 or ≥50), number of lesions (<200 or ≥200), restriction setting (present or absent), diagnostic classification for AFI (green-purple-ambiguous or green-purple), and diagnostic classification for NBI (Kudo pit pattern or Sano pattern). Detailed information is presented.
in Tables 4 and 5. It can be seen from the tables that the diagnostic classification and restriction setting was found to affect the heterogeneity for AFI and NBI. Subsequently, we performed the subgroup analysis with two groups for each modality based on the corresponding variables. Subgroup analysis for AFI indicated that the heterogeneity remained high in sensitivity and DOR estimate of 7 studies using the “green-purple-ambiguous” pattern, however, the heterogeneity decreased greatly in specificity. On the other hand, subgroup analysis for NBI indicated that the heterogeneity decreased greatly in all pooled estimates of 5 studies without restrictions, however, heterogeneity increased in all pooled estimates of studies with restrictions. All these results indicate that meta-regression analysis only solved the problem of heterogeneity partially.

**DISCUSSION**

The AFI and NBI video endoscope systems have been considered to play an important role in the future detection of colonic cancers because both systems have been shown to improve the mucosal visualization compared to WLC. Our meta-analysis focused on evaluating the diagnostic ability of AFI and NBI for colonic cancers and revealed that both AFI and NBI had relatively high sensitivities but low specificities in the differentiation of colonic lesions. Furthermore, the combination of AFI and NBI was associated with increased diagnostic value for colonic cancers compared with AFI and NBI alone.

Although the merit of these two systems have been recognized in a number of studies, there have been mixed results in the use of AFI and NBI for the detection and characterization of polyps in the colon. Matsuda et al. demonstrated that AFI improved the detection of colonic polyps, with lower miss-rate compared with WLC. The large study conducted by Sato et al. reported that AFI could distinguish adenoma from hyperplastic polyps with an accuracy of 94.9%, whereas HRE exhibited an accuracy of 75.9%. On the contrary, Kuiper et al. demonstrated that AFI did not significantly reduce the adenoma miss-rate compared with the standard WLC, and the results from Ignjatovic et al. indicated that AFI was not useful in the differentiation of small polyps (≤10 mm). On the other hand, Rastogi et al. and Inoue et al. have proved the usefulness of NBI for detecting colon polyps and with magnification. However, from another aspect, a review indicated that high-definition (HD) NBI did not increase the detection of colon polyps, adenomas, or flat adenomas nor did it decrease the miss-rate of colon polyps or adenomas in...
patients undergoing screening colonoscopy when compared with HD-WLC.\textsuperscript{[29]} Some studies have also pointed out that NBI did not have better sensitivity, specificity, or accuracy for colonic polyp characterization compared with WLC.\textsuperscript{[22,24]} We first reported that AFI and NBI had similar sensitivities of 84% and specificities of 44% and 69%, respectively, in the differentiation of colonic lesions when the diagnostic indices were pooled with a random effects model. In general, a high sensitivity is considered more important than a high specificity in differentiating lesions because it is imperative to not leave any adenomas \textit{in situ}.\textsuperscript{[22,24]} However, in the current study, sensitivities of NBI and AFI should be deemed clinically unacceptable because approximately 16% of all detected adenomas would be \textit{left in situ}.\textsuperscript{[22,24]}

In our study, the AFI had a similar sensitivity but a lower specificity compared with NBI, and the diagnostic efficacy of AFI was also lower than NBI. These results seem to be inconsistent with the study from Suzuki et al., which concluded that AFI might be more effective for the characterization of colorectal adenomas than NBI.\textsuperscript{[1]} The main reason for this difference may be that a unique research method was used by Suzuki et al., which compared the visualization quality between the two modalities. The inclusion of patients may also play a role in this situation. Although the AFI system demonstrates significantly better visualization of colorectal adenomas compared to the NBI system, the results may be different when the diagnostic performance is compared, including colonic lesions such as inflammatory bowel disease or familial adenomatous polyposis.

AFI uses tissue function to yield real-time pseudocolor images and has a potential to serve as a “red flag” technique for the detection of neoplastic lesions. Several studies in recent years have proved that AFI could improve the detection of relevant lesions but might give false positive findings concerning Barrett’s esophagus or gastric neoplasia.\textsuperscript{[16,31]} The results from our study proved the similarity for colonic cancers. On the other hand, NBI can enhance the contrast of the superficial mucosal and vascular patterns. This is helpful to confirm the suspicious surface structures, which may provide a possibility of reducing the false positive rate caused by AFI. This assumption has been certified by the same studies which also tried to explore the role of NBI for esophageal and gastric lesions.\textsuperscript{[16,31]} Therefore, we aimed to find out the diagnostic efficacy of AFI combined with NBI for colonic cancers in our study as well. Four studies were selected for our analysis, for which AFI was used for the detection of lesions and NBI was used for differentiation of lesions subsequently. It can be observed from Figure 4 that AFI plus NBI had a higher sensitivity estimate compared to AFI or NBI alone, and the specificity estimate was also higher than AFI alone. Such findings indicate that an additive effect may exist, and a lower false positive rate of AFI can be achieved after detailed inspection with NBI. Furthermore, the higher DOR estimate and AUC for AFI plus NBI compared with AFI or NBI alone in this study also arouses our interest toward the utility of this combination for routine inspection. ETMI has brought convenience to the conventional use of AFI and NBI by allowing switching from one imaging mode to another with a button in the control head of an endoscope. Moreover, combining AFI and NBI data has been proved to provide greater accuracy, with equal results between experienced and nonexperienced endoscopists.\textsuperscript{[15]}

There are several limitations of our study. But, the main limitation is the heterogeneity among the studies that have evaluated in our meta-analysis. We explored the source of heterogeneity by sensitivity analysis and meta-regression analysis, however, this could only solve the problem partially. The diagnostic classification used by Sato et al. providing a more unique measurement to the differentiation of neoplastic and non-neoplastic lesions with AFI,\textsuperscript{[25]} brought about heterogeneity with other studies.\textsuperscript{[12,31]} On the other hand, NBI had lower sensitivities for the differentiation of ulcerative colitis, sessile serrated adenomas, and small

### Table 5: Meta-regression analysis for possible sources of heterogeneity for NBI

| Inverse variance weights | Coefficient | Standard error | P value |
|--------------------------|-------------|----------------|---------|
| Cte                      | 4.371       | 1.1088         | 0.06    |
| S                        | -0.368      | 0.2692         | 0.31    |
| Classification (NBI)     | 0.757       | 0.4137         | 0.21    |
| Patient                  | 0.768       | 0.7359         | 0.41    |
| Lesion                   | -1.960      | 1.3884         | 0.29    |
| Restriction              | -2.740      | 1.1184         | 0.13    |

**Note:**

| Inverse variance weights | Coefficient | Standard error | P value |
|--------------------------|-------------|----------------|---------|
| Cte                      | 4.444       | 1.1067         | 0.03    |
| S                        | -0.472      | 0.2501         | 0.16    |
| Classification (NBI)     | 0.737       | 0.4133         | 0.17    |
| Lesion                   | -1.125      | 1.1345         | 0.39    |
| Restriction              | -2.661      | 1.1158         | 0.10    |

**Note:**

| Inverse variance weights | Coefficient | Standard error | P value |
|--------------------------|-------------|----------------|---------|
| Cte                      | 3.425       | 0.4103         | 0.0011  |
| S                        | -0.508      | 0.2475         | 0.11    |
| Classification (NBI)     | 0.672       | 0.4080         | 0.18    |
| Restriction              | -1.621      | 0.3827         | 0.01    |

**Note:**

| Inverse variance weights | Coefficient | Standard error | P value |
|--------------------------|-------------|----------------|---------|
| Cte                      | 2.615       | 0.4228         | 0.0016  |
| S                        | -0.135      | 0.2767         | 0.65    |
| Classification (NBI)     | 1.051       | 0.9120         | 0.30    |

**Note:**

| Inverse variance weights | Coefficient | Standard error | P value |
|--------------------------|-------------|----------------|---------|
| Cte                      | 3.676       | 0.4117         | 0.0003  |
| S                        | -0.495      | 0.2617         | 0.12    |
| Restriction              | -1.826      | 0.4675         | 0.01    |
colonic polyps (≤10 mm) in the restricted studies,[20,21,23] which was found to affect the heterogeneity for NBI. More related studies are needed to further explore the definite reasons for these specific situations. Another limiting of our study is that the interobserver agreements. High interobserver agreement between all colonoscopists is required if optical diagnosis is to become acceptable in routine clinical practice. However, only two included studies discussed the interobserver agreements of AFI and NBI and provided the kappa values.[22,25] Further studies are needed not only to evaluate the interobserver agreement of each modality but also to evaluate the differences between expert and nonexpert endoscopists.

CONCLUSION

In conclusion, both AFI and NBI have relatively high sensitivities but low specificities in the differentiation of colonic lesions; the diagnostic accuracy requires further improvements for both the modalities. The combination of AFI and NBI, which is generally realized by the use of ETMI, is associated with increased diagnostic value for colonic cancers compared with AFI and NBI alone. More prospective trials should be performed to explore the differences of application values between ETMI and other endoscopic techniques.

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Conflicts of interest

There are no conflicts of interest.

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