Thieme

Detection of lesions in dysplastic Barrett's esophagus by community and expert endoscopists

Authors
Dirk W. Schölvinck[1,2], Kim van der Meulen[1], Jacques J. G. H. M. Bergman[2], Bas L. A. M. Weusten[1,2]

Institutions
1 Department of Gastroenterology and Hepatology, St Antonius Hospital, Nieuwegein, Netherlands
2 Department of Gastroenterology and Hepatology, Academic Medical Center, Amsterdam, Netherlands

submitted 10.5.2016
accepted after revision 14.9.2016

Bibliography
DOI http://dx.doi.org/10.1055/s-0042-118312
Published online: 17.11.2016 | Endoscopy 2017; 49: 113–120

ISSN 0013-726X

Corresponding author
Bas L. A. M. Weusten, MD, PhD, Department of Gastroenterology and Hepatology, St. Antonius Hospital, Koekoekslaan 1, 3435 CM, Nieuwegein, The Netherlands
Fax: +31-88-3203000
b.weusten@antoniusziekenhuis.nl

ABSTRACT

Background and aims Endoscopic treatment of Barrett's esophagus (BE) consists of endoscopic resection of visible lesions followed by radiofrequency ablation (RFA) for any remaining flat BE. Because RFA is only justified in flat BE, detection of neoplastic lesions (high grade dysplasia [HGD] and early adenocarcinoma [EAC]) is crucial. We hypothesized that the detection of visible lesions containing HGD or EAC would be superior in BE expert centers compared with community hospitals, thereby supporting centralization of therapy for BE-related neoplasia.

Methods Patients referred with histologically proven HGD or EAC to two Dutch BE expert centers were included. Referral letters, and endoscopy and pathology reports were reviewed for the description of the BE, presence of lesions, and histopathological analysis of target and random tissue sampling. Primary outcome was the endoscopic detection rate of lesions containing histopathologically proven neoplasia (HGD and/or EAC) in community and expert centers.

Results There were 198 patients referred from 37 community hospitals (median referral time 55 days [interquartile range 33 – 85]). Detection rates for visible lesions were 60 % in community centers (75 % in patients with a biopsy diagnosis of EAC, 47 % in HGD) and 87 % in expert centers (98 % in EAC, 75 % in HGD); $P<0.001$. Even with HGD/EAC on random biopsies from the index endoscopy, the yield at repeat endoscopy was <50 % in community hospitals. In 79 patients referred solely because of random biopsy results, a lesion requiring endoscopic resection or surgery was found in 76 % by the expert endoscopists.

Conclusions Endoscopists at community hospitals detect neoplastic lesions at a significantly lower rate. These data support the value of BE expert centers for work-up and further treatment of BE.

Introduction

Barrett's esophagus (BE) is a precursor of esophageal adenocarcinoma. Malignant degeneration of BE occurs typically through a multistep transition from non-dysplastic intestinal metaplasia (NDBE) to low grade dysplasia (LGD), high grade dysplasia (HGD), and finally invasive adenocarcinoma [1, 2].

The annual incidence of early adenocarcinoma (EAC) found in non-dysplastic BE is estimated to be 0.12 % – 0.43 % [3 – 7]. In contrast, the risk of progression from LGD, when confirmed by an expert pathologist, to HGD or EAC is estimated to be 4.7 % – 13.4 % per patient-year [8 – 10]. Regular endoscopic surveillance is therefore recommended in patients with BE, although its benefits and adherence to this is currently under debate [11].

The presence of HGD and intramucosal adenocarcinoma is an established indication for endoscopic therapy by means of endoscopic resection, radiofrequency ablation (RFA), or a combination thereof [11]. Any visible lesion in the Barrett segment should be resected for assessment of its histopathological characteristics [12]. In case further endoscopic treatment is indicated, additional endoscopic resection and/or RFA of the remaining flat Barrett segment is recommended because the risk of metachronous lesions is estimated to be up to 30 % [2, 13].

Surveillance endoscopies for BE are predominantly performed in community hospitals; however, most experts advocate for the treatment of BE-related neoplasia to be centralized in expert centers. Data to support centralization of care for BE-related neoplasia are however scarce. We hypothesized that any additional yield from centralization would (at least in part) be due to the identification of dysplastic lesions. The identification of early dysplastic lesions is crucial because resection of all visible lesions is required before RFA is used so as to avoid incomplete or insufficient treatment.

This study therefore sought to evaluate the detection rates of neoplastic lesions in BE by endoscopists from community hospitals and from expert centers, and to assess the predictive factors influencing these detection rates.

Methods

Study design

This multicenter retrospective study was conducted in two expert centers in the Netherlands (The Academic Medical Center and St. Antonius Hospital). The institutional review board granted exemption from approval for this study. All consecutive patients with BE referred to the tertiary centers with a diagnosis of HGD or EAC between January 2008 and December 2013 were retrospectively identified from BE-dedicated databases at the expert centers. Patients were excluded when they had been examined only in the tertiary center, referred for a recurrent HGD or EAC diagnosis, or if they had undergone previous esophageal endoscopic treatment (i.e. endoscopic resection, RFA, photodynamic therapy).

Endoscopic detection and surveillance of Barrett's esophagus

The participating expert endoscopists (J.B. and B.W., both with >10 years of BE experience) adhere to local and international guidelines for the detection, surveillance, and treatment of BE [11, 14–16]. In the expert centers, high definition resolution (HDR) white-light imaging and narrow-band imaging (NBI) were used. The BE was described by the location of endoscopic landmarks, such as the diaphragm, esophagogastric junction, and circumferential (C) and maximum (M) extent of the BE. Accordingly, the length of the Barrett's segment was described using the Prague classification [17]. Any visible lesion, defined as "any abnormality of the mucosal and/or vascular pattern suggestive of dysplasia or cancer," was characterized using the Paris classification to estimate the feasibility of endoscopic treatment (▶ **Table 1**) [18]. During mapping endoscopy, four-quadrant random biopsies were collected every 2 cm, along with targeted sampling of any visible abnormalities [14, 16].

Histology

The specimens were fixed in buffered 10% formalin (≥24 hours), embedded in paraffin, cut into 2-µm slides, and stained with hemotoxylin and eosin (H&E), according to routine processing protocols. Processing with additional stains was allowed. Grading of dysplasia was performed according to the revised Vienna classification [19, 20].

Referral process

The patients included had been referred to the expert centers when they were diagnosed with HGD or EAC on a biopsy after histopathological examination in the community hospital. A referral letter and the relevant endoscopy and pathology reports were sent to the expert center where the patient was scheduled to be seen on a BE-dedicated endoscopy program. If, during expert endoscopy, the referral HGD or EAC diagnosis could not be confirmed (i.e. no lesion was detected and no HGD or EAC was found in any biopsy), the original biopsy specimens from the community hospital were reviewed by an expert pathologist. If the presence of HGD or EAC could not be confirmed on the expert pathology review either, the patient was excluded.

Data collection

For this study all endoscopy and pathology reports, along with the referral letters from the community hospitals were reviewed. Assessed endoscopic data were: the type of sedation, the type of imaging, BE length, the location and Paris classification of any visible lesion, and whether targeted and/or random biopsies had been obtained. Histopathological data collected were: the presence of BE, the type of dysplasia, and the location where HGD and EAC was found. Additionally, the number of endoscopies performed in the community hospitals after the first diagnosis of HGD or EAC, as well as the time to referral, was assessed. Endoscopic and histopathological data from the expert centers were retrieved from a prospectively populated database.

Outcome parameters

The primary outcome parameters were: the endoscopic detection rates of lesions with histopathologically proven HGD or EAC in the community hospitals and in the expert centers; and

▶ **Table 1** The Paris classification.

Paris classification	Description	Patients with visible lesions at expert centers (n = 172)
Type 0-I	Polypoid	23
▪ Type 0-Ip	Protruded, pedunculated	Not specified
▪ Type 0-Is	Protruded, sessile	Not specified
Type 0-II	Non-polypoid	134
▪ Type 0-IIa	Slightly elevated	117
▪ Type 0-IIb	Flat	15
▪ Type 0-IIc	Slightly depressed	2
Type 0-III	Excavated	0
Advanced carcinoma		15

the percentage of patients referred without visible lesions who had a lesion with HGD or EAC detected in the expert center.

Secondary outcome parameters were: predictive factors for overlooked lesions in the community hospitals; the number of endoscopies performed in the community hospitals after the diagnosis of HGD or EAC was first made; and the time between first detection of HGD or EAC in the community hospital and the first endoscopy in the expert center.

Statistical analysis

Continuous variables are presented as: the mean (± standard deviation) and were compared with the *t* test when normally distributed; or as the median (interquartile range [IQR]) and were compared with the Mann–Whitney *U* test if they had a skewed distribution. Categorical data are given as percentages and were compared with the *Z* test for proportions or with the Fisher exact test.

Odds ratios (ORs) with 95 % confidence interval (CI) were used to quantify predictive associations for factors influencing the detection of lesions in the referring hospitals. Potential predictors were: endoscopic factors, such as the type of imaging, the use of conscious sedation, and the study period (2008–2010 vs. 2011–2013); and BE-specific characteristics, such as the length of the BE segment, the Paris classification, and the grade of neoplasia. For the length of BE segment and Paris classification, the expert findings were used as the gold standard. For predictive analysis, the Paris classifications were grouped in an "easily detectable" category (advanced carcinomas, 0-I, 0-IIa, and 0-III) versus a "difficult to detect" category (0-IIb and 0-IIc).

Database management and statistical analysis was performed with statistical software package SPSS 20.0.0.1 (SPSS Inc., Chicago, Illinois, USA).

Results

Baseline characteristics

A total of 218 patients referred with HGD or EAC were identified in the two expert centers. There were 20 patients who were excluded because of the lack of referral data (n = 6), referral indicating advanced carcinoma (n = 2), downstaging of the referral diagnosis by an expert pathologist (n = 7), previous endoscopic treatment for neoplasia (n = 3), and the inability to obtain pathology by endoscopic resection in the expert center owing to the presence of esophageal varices (n = 2). The baseline characteristics of the 198 eligible patients are shown in ▶ **Table 2**.

▶ **Table 2** Baseline characteristics of the 198 eligible patients referred from the 37 community hospitals with Barrett's esophagus and high grade dysplasia or early adenocarcinoma.

Baseline characteristic	
Age, mean ± SD, years	66 ± 11
Male sex, n (%)	172 (87 %)
Barrett length (Prague classification)	
▪ Circumferential extent, mean ± SD, cm	3.8 ± 3.9
▪ Maximum extent, mean ± SD, cm	5.7 ± 3.9
Referral diagnosis	
▪ High grade dysplasia, n (%)	104 (52 %)
▪ Early adenocarcinoma, n (%)	94 (47 %)

SD, standard deviation.

Detection of lesions at community hospitals

In 101 patients (51 %) a visible abnormality containing HGD/EAC (proven by targeted biopsies) was detected during the index endoscopy at the community hospital (▶ **Fig. 1**). In 97 patients (49 %), HGD or EAC was detected by random biopsies.

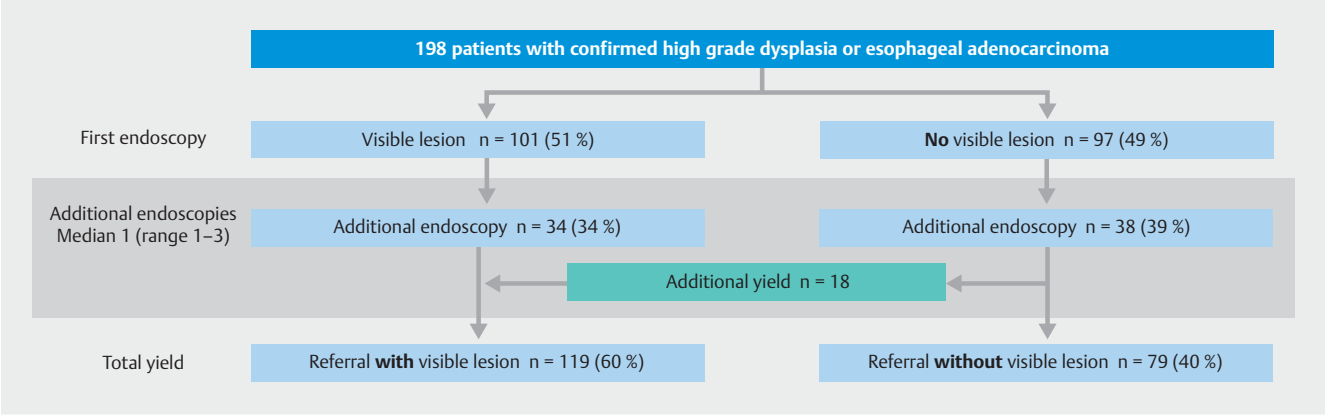
After revealing HGD/EAC at the index endoscopy, endoscopy was repeated in 72 patients (36 %). In the 101 patients with a visible lesion, repeat endoscopy was performed in 34 (one additional endoscopy in 31 patients, two additional endoscopies in two patients, and three additional endoscopies in one patient). In the 97 patients with HGD/EAC in random biopsies at index endoscopy, endoscopy was repeated in 38 (one additional endoscopy in 30 patients, two extra endoscopies in eight patients). The repeat endoscopies in these 38 patients with HGD/EAC in random biopsies at index endoscopy resulted in an additional 18 patients being found to have a visible lesion containing HGD/EAC. As a result, 119 patients (60 %) were referred to the expert center with a visible lesion containing HGD/EAC, and 79 patients (40 %) were referred with HGD/EAC in random biopsies only.

For all patients, the median time between the HGD/EAC detection in the community hospital and the first endoscopy at the expert center was 55 days (IQR 33–85). The median referral time was 47 days (IQR 30–66) in the 126 patients who were referred after the first endoscopy, and 80 days (IQR 49–136) in the 72 patients who had undergone additional endoscopies in the community hospitals ($P < 0.001$). In 16 patients (8 %) the referral interval was more than 6 months between the HGD or EAC diagnosis and the first expert endoscopy.

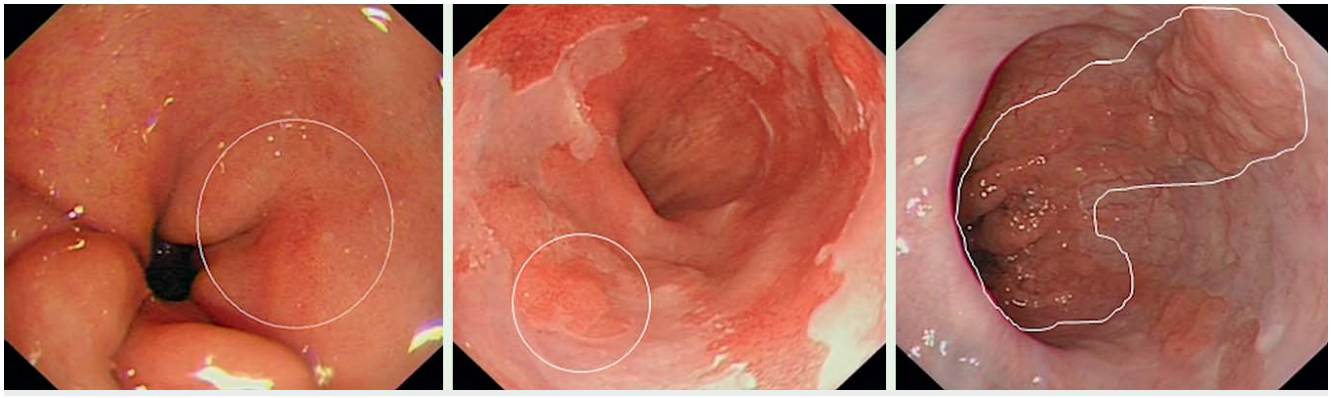
Detection of lesions at expert centers

The expert endoscopists detected a visible lesion in 172 of 198 patients (87 %), compared with 119 of 198 patients (60 %) at the community hospitals ($P < 0.001$). In the 119 patients referred with a visible lesion, the visible lesion was confirmed by the expert endoscopists in 112 patients (94 %). In seven patients (6 %) the expert endoscopist was unable to detect a visible lesion.

In the 79 patients referred without a visible lesion, a visible lesion was detected by the expert endoscopists in 57 patients (72 %); example lesions are shown in ▶ **Fig. 2**. In 22 patients (28 %) the expert endoscopists agreed on the absence of visible lesions. During subsequent endoscopy in those 22 patients, three more lesions appeared that required an endoscopic resection, resulting in a total of 60 patients (76 %) with a visible lesion versus 19 (24 %) with no visible lesion.



▶ **Fig. 1** Flowchart of lesion detection in community hospitals showing the detection of visible lesions in the community hospitals at first endoscopy and after additional endoscopies (when performed) among the 198 patients with Barrett's esophagus and pathology showing high grade dysplasia or early adenocarcinoma.



▶ **Fig. 2** Examples of lesions overlooked at community centers but detected during endoscopy in the expert centers.

Treatment strategy and pathology at the expert centers

▶ **Fig. 3** shows the treatment strategy with associated pathology results in the expert centers. Of the 112 patients with a visible lesion in the community and expert center, 11 (10 %) were found to have an advanced carcinoma at expert endoscopy. The other 101 patients underwent a diagnostic endoscopic resection of the visible lesion. Histopathology showed NDBE/LGD (n = 2), HGD in (n = 13), EAC-T1a (n = 64), and EAC-T1b (n = 22). All of these patients were further treated according to international guidelines.

In the seven patients referred with a visible lesion that could not be confirmed by the expert endoscopists, direct RFA without prior endoscopic resection was performed in five patients. One of the other patients had a signet-cell EAC in random biopsies and was immediately referred for esophagectomy and the final patient declined further treatment because of severe comorbidity.

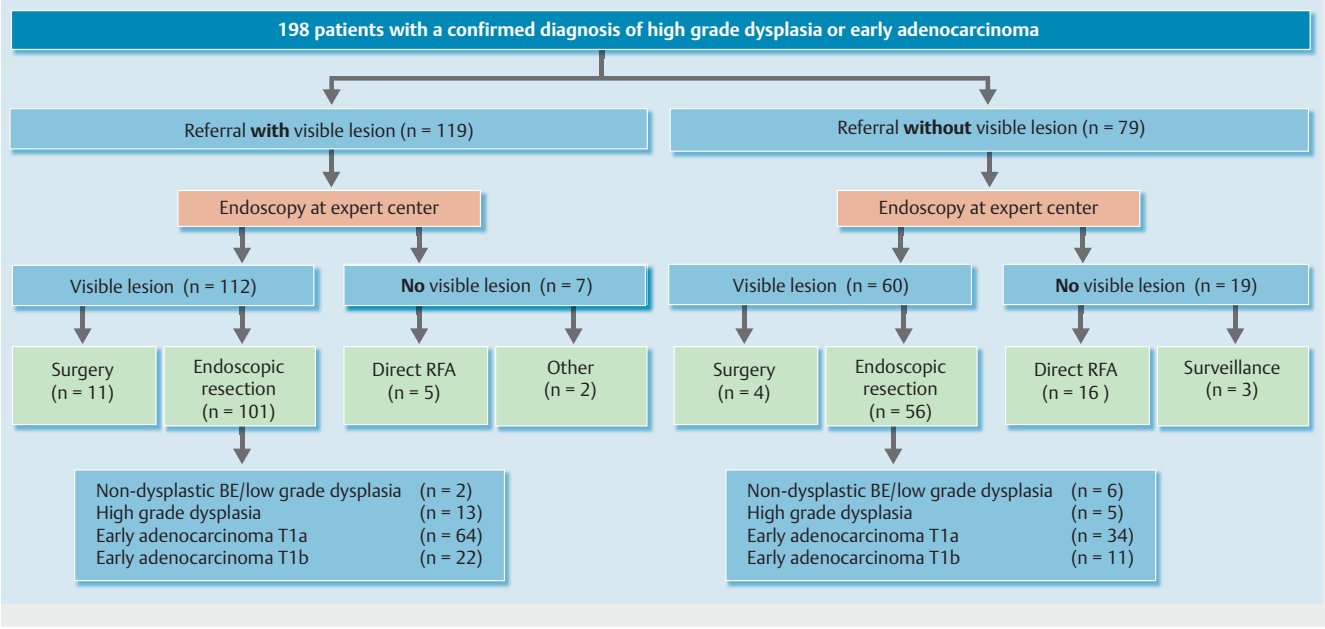
Of the 60 patients referred without visible lesions who then had a visible lesion found at the expert center, four were found to have an advanced carcinoma at endoscopy. The other 56 patients underwent a diagnostic endoscopic resection of the lesion for which histopathology showed NDBE/LGD (n = 6), HGD (n = 5), EAC-T1a (n = 34), and EAC-T1b (n = 11). All of these patients were further treated according to international guidelines.

Of the remaining 19 patients (no visible lesion seen at either the community or expert center), 16 underwent direct RFA. In three patients the referral diagnosis of HGD could not be reproduced during subsequent endoscopies. These patients were kept under strict surveillance and no neoplasia was found at a median of 3 years follow-up.

Factors predictive of the detection of lesions

Because the type of imaging was poorly reported from the community hospitals, given in only 34 % of the endoscopy reports, this data could not be included in the analysis of possible predictive factors for the detection of lesions in community centers.

Overall, univariate analysis detected two predictive factors: Paris type ("easily detectable" [advanced carcinomas, 0-I, 0-IIa, and 0-III] versus "difficult to detect" [0-IIb and 0-IIc]) and the presence of adenocarcinoma on histology (▶ **Table 3**). Of the 172 lesions that were Paris classified by the expert endoscopists, 106/112 (95 %) of the lesions that had been detected



▶ **Fig. 3** Flowchart of detection and treatment strategy of patients with Barrett's esophagus (BE) at expert centers, along with pathology outcomes of the endoscopic resection specimens. A total of 60/198 patients were referred without a visible lesion having been seen but had a visible lesion detected at the expert center. In the category "other," one patient was not treated because of comorbidity and one patient had signet-cell EAC in the random biopsies and underwent an esophagectomy (RFA, radiofrequency ablation).

at the community hospitals and 49/60 (82 %) of the lesions that had not been detected were characterized as having an "easily detectable" Paris classification (OR = 3.97; $P = 0.01$). Secondly, the referral diagnosis was EAC in 70/119 patients (59 %) who had had a lesion detected at the community hospital and in 24/79 patients (30 %) who had not had a lesion detected (OR = 3.27; $P = 0.001$). Other factors such as the use of sedation, study period, and the BE length were not predictive of the detection of lesions in the community hospitals.

Multivariate analysis (Hosmer and Lemeshow test significance 0.77, Nagelkerke R^2 0.10) showed that both an "easily detectable" Paris classification (OR = 3.5 [95 %CI 1.2 – 10.2]; $P = 0.02$) and EAC as the referring diagnosis (OR = 2.3 [95 %CI 1.2 – 4.3]; $P = 0.01$) were independent predictors for the detection of lesions in the community hospitals.

Discussion

Surveillance programs for patients with BE aim to detect esophageal neoplasia at an early stage to provide the opportunity for early, minimally invasive treatment. It is therefore important that neoplastic lesions are recognized at an early stage during these surveillance endoscopies, which are often performed in community hospitals, and that the subsequent clinical steps are followed adequately.

In the current study, the detection of neoplastic lesions during BE surveillance in Dutch community and expert centers was evaluated. We found that almost 90 % of BE patients referred for work-up of HGD or EAC have endoscopically visible lesions. Referrals with HGD or EAC were based solely on random biopsy results in 40 % (79 of 198) of the patients. More importantly, in 54 of these 79 patients (68 %), a lesion was detected by the expert endoscopists that required endoscopic resection (HGD or EAC in 50 patients), or even surgery (four patients). In addition, we found that a referral diagnosis of EAC is virtually always associated with a visible lesion that requires endoscopic resection or surgery. Lastly, a referral diagnosis with "flat" HGD is associated with a visible lesion requiring intervention in 53 % of cases.

These findings are important in the developing discussion as to whether it is justified to expand the use of RFA treatment outside expert centers. RFA without prior endoscopic resection in these patients would have resulted in incomplete or insufficient treatment with a high chance of (sub-squamous) cancer recurrence. Therefore, these data support the value of expert centers for the work-up and treatment of BE. Moreover, our results are in line with the study of Cameron et al. [21] in which they found similar detection rates (42 % for the community hospitals versus 94 % for the expert center).

Several aspects may contribute to this difference in detection rates between community hospitals and expert centers. First, it should be recognized that, in contrast to the referring endoscopists, the expert endoscopists were aware of the HGD or EAC diagnosis before their initial endoscopy. Because the majority of cases of HGD or EAC seem to result in a visible lesion, the expert endoscopists therefore knew what they are looking for. Nevertheless, in patients in whom repeat endoscopies were performed by the referring endoscopist after the HGD/EAC diagnosis had become apparent, lesions were detected in 47 %, whereas in the expert centers the detection rate in this specific group was 92 % ($P < 0.001$).

▶ **Table 3** Univariate analysis of the factors predictive of detection of lesions in community hospitals.

	Patients with data available (lesion detected/no lesion detected)	Overall	Lesion detected	No lesion detected	Odds ratio (95% confidence interval)	*P* value
Endoscopy characteristics						
▪ Conscious sedation (used vs. not used)	161 (99/62)	64/161 (40%) used	41/99 (41%) used	23/62 (37%) used	1.20 (0.62–2.30)	0.59
▪ Detection period (2008–2010 vs. 2011–2013)	198 (118/80)	69/198 (35%) in 2011–2013	43/118 (36%) in 2011–2013	26/80 (33%) in 2011–2013	1.19 (0.65–2.17)	0.57
Barrett's esophagus characteristics						
▪ Circumferential BE length, cm	196 (117/79)	3.8±3.9	4.2±4.2	3.2±3.5	1.07 (0.99–1.15)	0.10
▪ Maximum BE length, cm	196 (117/79)	5.7±3.9	5.9±4.2	5.5±3.4)	1.03 (0.95–1.10)	0.52
▪ Paris classification (easily detectable[1] vs. difficult to detect)	172 (112/60)	155/172 (90%) easily detectable	106/112 (95%) easily detectable	49/60 (82%) easily detectable	3.97 (1.39–11.34)	0.01
▪ Referral pathology (high grade dysplasia vs. early adenocarcinoma)	198 (119/79)	94/198 (47%) early adenocarcinoma	70/119 (59%) early adenocarcinoma	24/79 (30%) early adenocarcinoma	3.27 (1.79–5.98)	0.001

[1] "Easily detectable" lesions include advanced carcinoma, 0-I, 0-IIa, and 0-III, according to the Paris classification.

A second factor is the higher caseload of patients with early neoplastic lesions in the expert centers compared with the occasional patient in community hospitals. This probably contributes to a learning effect in the recognition of these lesions by the expert endoscopists.

A third factor is the difference in quality of endoscopy in both centers, which is reflected in several parameters. In expert centers there is access to HDR white-light endoscopy and optical chromoendoscopy combined with the newest endoscopy processors, which may increase the detection of dysplasia in BE patients [22]; these are not always available in community hospitals. Moreover, the time scheduled for inspection at a mapping endoscopy in expert centers is generally longer than the time scheduled for surveillance endoscopy in a community hospital, which is associated with increased detection rates of HGD and EAC [23]. Unfortunately, these procedure data were not available for analysis.

We found conscious sedation was not a predictive factor for the detection of lesions at the community hospitals; however, the participating expert endoscopists have a strong preference for conscious sedation based upon experience. Remarkably no studies have assessed the role of sedation in the detection of neoplasia.

A final factor of influence may have been the interval between referral and the expert endoscopy being performed. The median interval was nearly 2 months, which is acceptable in terms of arranging the referral and planning the expert endoscopy; however, it is currently unclear if this interval allows such growth of a lesion that it results in easier detection by the expert endoscopist.

Nevertheless, in the expert centers too no visible lesion was detected in 19 (10%) of the patients. This may be explained by the fact that some HGD or EAC appear truly flat. For flat HGD, immediate ablation without prior endoscopic resection is accepted, whereas for flat EAC this is controversial as it has not been studied extensively [14, 15]. In some patients without a visible lesion, the expert endoscopists could not reproduce the HGD or EAC diagnosis, even after multiple endoscopies. Possibly this was because the neoplasia had a focal character and had been biopsied in total, or possibly regression of HGD truly had occurred.

The data found in this study confirm the value of expert centers for the detection and treatment of early neoplasia in BE patients. So how do these findings apply to the daily practice of community endoscopists? First, it is important to obtain random biopsies according to the Seattle protocol. Although its benefits are well studied, the adherence to this protocol remains poor (10%–79%) [24–26]. The fact that 40% of the patients in this study were referred on the basis of a diagnosis of HGD/EAC made on random biopsies highlights the value of obtaining random biopsies. Second, in this study 172 (87%) of the patients diagnosed with HGD or EAC had a visible lesion. This, and other literature [27], confirms that a visible lesion in the BE segment that requires endoscopic resection can often be found in cases of HGD or EAC.

Third, additional endoscopies at community hospitals after a known HGD/EAC diagnosis, which occurred in 72 (36%) of the

patients in this study, does not contribute to the clinical care of the patient. In case of doubt regarding the HGD/EAC diagnosis, biopsy revision by an expert pathologist is of more clinical value than performing additional mapping endoscopies. Although the median delay of 35 days in this study was not overly extensive, it still withholds necessary endoscopic treatment from the patient. Moreover, additional mapping endoscopies generate extra costs and repeat biopsy of visible lesions may hinder the ease of later endoscopic resection because of fibrosis. In addition, immediate referral will give access to endoscopic resection, which has a higher diagnostic value than a biopsy [12, 27, 28].

Next, how do the current findings apply to the daily practice of expert endoscopists? Although there is no general consensus that expert centers for the treatment of BE should comply with specific conditions, the new Dutch guideline (as yet unpublished) will implement certain requirements for "expert centers": (i) minimum case load of 10 new patients per year with dysplasia or EAC in BE to be treated in the expert center; (ii) the specialized care is delivered by one dedicated endoscopist and one or two pathologists, with documented training and expertise; (iii) availability of high resolution endoscopy (HDTV endoscope, processor, and display) and equipment for endoscopic resection and ablation for dysplasia or EAC in BE; (iv) multidisciplinary consultation with gastroenterologists, surgeons, oncologists, and pathologists regarding all patients with early cancer; (v) expertise in treating adverse events associated with endoscopic resection and ablation (i. e. bleeding and perforation), and access to esophageal surgery.

Although currently not used as a criterion, the rate of endoscopic resection performed in patients referred with a biopsy diagnosis of HGD/EAC might become a quality indicator for BE expert centers in the future. Wani et al. [27] found visible lesions in 86 % patients with proven HGD/EAC; in the European multicenter trial published by Phoa et al. [29], 90 % of patients with proven HGD/EAC required endoscopic resection before RFA treatment. Cameron et al. [21] performed an endoscopic mucosal resection (EMR) in 80 % of lesions with proven HGD/EAC (in 17/23 and 16/18 with HGD and EAC at baseline, respectively). In contrast, the UK RFA registry found that in their population between 2011 and 2013 only 60 % of the patients (7 LGD, 172 HGD, and 63 EAC in the baseline cohort) required endoscopic resection before RFA. However, this number is higher than the 2008 – 2010 period and may further increase with improvements in imaging [30]. Although our study shows comparable data (87 %), given the limitations of our study, additional studies are warranted to define a threshold for cases referred with a biopsy diagnosis of HGD and EAC

Besides the aforementioned factors that may explain the differences in detection rates, the main limitation of this study is its retrospective design, which limits the accuracy of the referral data. For example, in certain endoscopy reports a minor abnormality was described, but without characteristics such as size, Paris classification, and mucosal pattern. These were scored as "detected lesions," which may have caused a possible overestimation of the number of detected lesions in community hospitals. This will not however attenuate the aforementioned considerations for referral of HGD or EAC patients and, moreover, this study is a reflection of daily practice in the work-up of our population of BE patients.

In conclusion, our data support the value of expert centers for the detection and consequent endoscopic treatment of visible lesions in patients with a histopathological diagnosis of HGD or EAC. However, because the community centers are the first line in the detection of neoplastic lesions during BE surveillance, these data also suggest that standards of care in these centers should be improved in order to optimize BE surveillance programs.

Competing interests

Prof. J. J. G. H. M. Bergman received research support for institutional review board (IRB)-approved studies (Olympus Endoscopy, Cook Medical, Boston Scientific Corporation, GI Solutions Covidien, ERBE, and Ninepoint Medical, Fuji Film, Cernostics, Interpace), financial support for training programs (GI Solutions Covidien), and honorarium consultancy speaker's fees (Cook Medical, Boston Scientific Corporation, and GI Solutions Covidien). Prof. B. L. A. M. Weusten received research support for IRB-approved studies (GI Solutions Covidien, ERBE, and C2Therapeutics) and consultancy fees (Boston Scientific Corporation and C2Therapeutics). D. W. Schölvinck and K. van der Meulen have no conflicts of interest.

References

[1] Shaheen NJ, Richter JE. Barrett's oesophagus. Lancet 2009; 373: 850 – 861

[2] American Gastroenterological Association. Spechler SJ, Sharma P et al. American Gastroenterological Association medical position statement on the management of Barrett's esophagus. Gastroenterology 2011; 140: 1084 – 1091

[3] Desai TK, Krishnan K, Samala N et al. The incidence of oesophageal adenocarcinoma in non-dysplastic Barrett's oesophagus: a meta-analysis. Gut 2012; 61: 970 – 976

[4] Wani S, Falk G, Hall M et al. Patients with nondysplastic Barrett's esophagus have low risks for developing dysplasia or esophageal adenocarcinoma. Clin Gastroenterol Hepatol 2011; 9: 220 – 227 quiz e226

[5] Bhat S, Coleman HG, Yousef F et al. Risk of malignant progression in Barrett's esophagus patients: results from a large population-based study. J Natl Cancer Inst 2011; 103: 1049 – 1057

[6] Hvid-Jensen F, Pedersen L, Drewes AM et al. Incidence of adenocarcinoma among patients with Barrett's esophagus. NEJM 2011; 365: 1375 – 1383

[7] Gaddam S, Singh M, Balasubramanian G et al. Persistence of nondysplastic Barrett's esophagus identifies patients at lower risk for esophageal adenocarcinoma: results from a large multicenter cohort. Gastroenterology 2013; 145: 548 – 553; e541

[8] Duits LC, Phoa KN, Curvers WL et al. Barrett's oesophagus patients with low-grade dysplasia can be accurately risk-stratified after histological review by an expert pathology panel. Gut 2015; 64: 700 – 706

[9] Curvers WL, ten Kate FJ, Krishnadath KK et al. Low-grade dysplasia in Barrett's esophagus: overdiagnosed and underestimated. Am J Gastroenterol 2010; 105: 1523 – 1530

[10] Vieth M, Schubert B, Lang-Schwarz K et al. Frequency of Barrett's neoplasia after initial negative endoscopy with biopsy: a long-term histopathological follow-up study. Endoscopy 2006; 38: 1201 – 1205

[11] Shaheen NJ, Falk GW, Iyer PG et al. ACG Clinical Guideline: Diagnosis and management of Barrett's esophagus. Am J Gastroenterol 2016; 111: 30 – 50

[12] Moss A, Bourke MJ, Hourigan LF et al. Endoscopic resection for Barrett's high-grade dysplasia and early esophageal adenocarcinoma: an essential staging procedure with long-term therapeutic benefit. Am J Gastroenterol 2010; 105: 1276 – 1283

[13] May A, Gossner L, Pech O et al. Local endoscopic therapy for intraepithelial high-grade neoplasia and early adenocarcinoma in Barrett's oesophagus: acute-phase and intermediate results of a new treatment approach. Eur J Gastroenterol Hepatol 2002; 14: 1085 – 1091

[14] Fitzgerald RC, di Pietro M, Ragunath K et al. British Society of Gastroenterology guidelines on the diagnosis and management of Barrett's oesophagus. Gut 2014; 63: 7 – 42

[15] ASGE Standards of Practice Committee. Evans JA, Early DS et al. The role of endoscopy in Barrett's esophagus and other premalignant conditions of the esophagus. Gastrointest Endosc 2012; 76: 1087 – 1094

[16] CBO Kwaliteitsinstituut voor de Gezondheidszorg. Richtlijn diagnostiek en behandeling oesofaguscarcinoom. In: Alphen aan den Rijn. Van Zuiden Communications. 2005

[17] Sharma P, Dent J, Armstrong D et al. The development and validation of an endoscopic grading system for Barrett's esophagus: the Prague C & M criteria. Gastroenterology 2006; 131: 1392 – 1399

[18] The Paris endoscopic classification of superficial neoplastic lesions: esophagus, stomach, and colon: November 30 to December 1, 2002. Gastrointest Endosc 2003; 58: S3 – S43

[19] Schlemper RJ, Kato Y, Stolte M. Review of histological classifications of gastrointestinal epithelial neoplasia: differences in diagnosis of early carcinomas between Japanese and Western pathologists. J Gastroenterol 2001; 36: 445 – 456

[20] Schlemper RJ, Kato Y, Stolte M. Diagnostic criteria for gastrointestinal carcinomas in Japan and Western countries: proposal for a new classification system of gastrointestinal epithelial neoplasia. J Gastroenterol Hepatol 2000; 15: G49 – G57

[21] Cameron GR, Jayasekera CS, Williams R et al. Detection and staging of esophageal cancers within Barrett's esophagus is improved by assessment in specialized Barrett's units. Gastrointest Endosc 2014; 80: 971 – 983; e971

[22] Qumseya BJ, Wang H, Badie N et al. Advanced imaging technologies increase detection of dysplasia and neoplasia in patients with Barrett's esophagus: a meta-analysis and systematic review. Clin Gastroenterol Hepatol 2013; 11: 1562 – 1570; e1561 – e1562

[23] Gupta N, Gaddam S, Wani SB et al. Longer inspection time is associated with increased detection of high-grade dysplasia and esophageal adenocarcinoma in Barrett's esophagus. Gastrointest Endosc 2012; 76: 531 – 538

[24] Curvers WL, Peters FP, Elzer B et al. Quality of Barrett's surveillance in The Netherlands: a standardized review of endoscopy and pathology reports. Eur J Gastroenterol Hepatol 2008; 20: 601 – 607

[25] Ramus JR, Caygill CP, Gatenby PA et al. Current United Kingdom practice in the diagnosis and management of columnar-lined oesophagus: results of the United Kingdom National Barrett's Oesophagus Registry endoscopist questionnaire. Eur J Cancer Prev 2008; 17: 422 – 425

[26] Fitzgerald RC, Saeed IT, Khoo D et al. Rigorous surveillance protocol increases detection of curable cancers associated with Barrett's esophagus. Dig Dis Sci 2001; 46: 1892 – 1898

[27] Wani S, Abrams J, Edmundowicz SA et al. Endoscopic mucosal resection results in change of histologic diagnosis in Barrett's esophagus patients with visible and flat neoplasia: a multicenter cohort study. Dig Dis Sci 2013; 58: 1703 – 1709

[28] Ayers K, Shi C, Washington K et al. Expert pathology review and endoscopic mucosal resection alters the diagnosis of patients referred to undergo therapy for Barrett's esophagus. Surg Endosc 2013; 27: 2836 – 2840

[29] Phoa KN, Pouw RE, Bisschops R et al. Multimodality endoscopic eradication for neoplastic Barrett oesophagus: results of an European multicentre study (EURO-II). Gut 2016; 65: 555 – 562

[30] Haidry RJ, Butt MA, Dunn J et al. Radiofrequency ablation for early oesophageal squamous neoplasia: outcomes from United Kingdom registry. World J Gastroenterol 2013; 19: 6011 – 6019