Factors associated with the efficacy of polyp detection during routine flexible sigmoidoscopy

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Abstract

Objective:

Flexible sigmoidoscopy reduces the incidence of colonic cancer through the detection and removal of premalignant adenomas. However, the efficacy of the procedure is variable. The aim of the present study was to examine factors associated with the efficacy of detecting polyps during flexible sigmoidoscopy.

Design & Patients:

Retrospective observational cohort study of all individuals undergoing routine flexible sigmoidoscopy in NHS Greater Glasgow & Clyde from January 2013 to January 2016.

Results:

A total of 7713 patients were included. Median age was 52 years and 50% were males. Polyps were detected in 1172 (13%) patients. On multivariate analysis, increasing age (OR 1.020 (1.016 – 1.023) $p<0.001$), male sex (OR 1.23 (1.10 – 1.38) $p<0.001$) and the use of any bowel preparation (OR 3.55 (1.47 – 8.57) $p<0.001$) was associated with increasing numbers of polyps being detected. There was no significant difference in the number of polyps found in patients who had received an oral laxative preparation compared with an enema (OR 3.81 (1.57 – 9.22) vs 3.45 (1.43 – 8.34)), or in those who received sedation versus those that had not (OR 1.00 vs 1.04 (0.91 – 1.17) $p=0.591$). Furthermore, the highest number of polyps was found when the sigmoidoscope was inserted to the descending colon (OR 1.30 (1.04 – 1.63)).

Conclusions:

Increasing age, male sex and the utilisation of any bowel preparation were associated with an increased polyp detection rate. However, the use of sedation or oral laxative preparation appears to confer additional benefit. In addition, the results indicate that insertion to the descending colon optimises the efficacy of flexible sigmoidoscopy polyp detection.

What is already known about this subject?

Standardisation of flexible sigmoidoscopy is lacking, and as a result the efficacy of the polyp detection is variable in clinical practice. Increasing age and male sex have been shown to be associated with an increased polyp detection rate. However, data regarding the association between polyp detection and endoscopist factors, such as the length of bowel examined and the use of bowel preparation, is incomplete.

What are the new findings?

The results of this present study indicate that insertion to the descending colon optimises the efficacy of flexible sigmoidoscopy polyp detection. Furthermore, there was no significant difference in the number of polyps found in patients that had received an oral laxative preparation compared to an enema.

How might it impact on clinical practice in the foreseeable future?

Compelling evidence indicate that flexible sigmoidoscopy may be an important screening modality in the future, with the results of this study providing information that could help better standardise its use in clinical practice.

Introduction

Colorectal cancer (CRC) is the third most common cancer in the Western world with around 40,000 people diagnosed and around 16,000 deaths occurring annually in the UK alone [1]. Earlier TNM stage at diagnosis, is associated with improved survival rates [2] and so in this modern age of preventative medicine, screening for CRC has become increasingly important. Screening is useful both in detecting early stage disease and in preventing CRC through the removal of pre-malignant adenomata [3].

Currently, the major screening programme within the UK is biennial guaiac-based faecal occult blood testing (gFOBt) which has been shown to reduce cancer-specific mortality by around 25% [4]. However, gFOBt has limited impact on incidence and hence alternative screening methods are now suggested. Flexible sigmoidoscopy has been introduced within England as an adjunct to the current screening programme [5] as there is high level evidence that this form of screening is both safe and effective at reducing the incidence of left sided disease [6].

However, standardisation of the procedure of flexible sigmoidoscopy is lacking. For example, four large randomised trials examining flexible sigmoidoscopy screening [7, 8, 9, 10] all differ in their use of sedation, maximum distance the scope is inserted by the endoscopist, definition of positive test and hence positivity rates. An examination of these factors associated with the efficacy of flexible sigmoidoscopy to detect polyps is required to guide optimal clinical practice.

The aim of the present study was to examine current routine flexible sigmoidoscopy practice within NHS Greater Glasgow and Clyde (NHS GG&C), and to determine those factors associated with the detection of polyps.

Patients and Methods

An observational cohort study in which participants were identified retrospectively utilising a prospectively maintained Unisoft endoscopy database was performed. Data was extracted for all patients undergoing a flexible sigmoidoscopy in NHS GG&C over a three-year period [January 2013 to January 2016, date of extraction January 2016]. Details regarding patient demographics, indications, sedation, bowel preparation, distance of maximum insertion, pathology encountered, number of polyps, area of most proximal polyp and reason for withdrawal were obtained, along with the priority of the investigation and speciality of the endoscopist. For the purposes of maximum distance scope inserted to, the rectosigmoid junction was considered as the rectum. Endoscopists were classified according to their specialty background as being either a consultant surgeon, consultant gastroenterologist, nurse endoscopist or trainee (any specialty of doctor not at consultant grade).

Information regarding pathology encountered was obtained based on macroscopic evaluation by the endoscopist. The presence of diverticulitis, colitis, haemorrhoids or pseudopolyps were classified as non-neoplastic colorectal pathology. The finding of pseudopolyps were not considered to be relevant to the study, as they are an entity of inflammatory bowel disease with limited malignant potential [11]. Indications for the procedure and the number of polyps found were sub-classified as per the British Society of Gastroenterology (BSG) guidelines [12, 13].

Patients were excluded if they were undergoing a repeat procedure, were undergoing routine inflammatory bowel disease assessment, had had previous resectional surgery, were involved in the Scottish Bowel Scope Screening Pilot study [14] or those in whom incomplete information was recorded.

This study was carried out utilising a local dataset and so no formal ethical review or individual patient consent was sought [15]. Data was stored and statistically analysed in an anonymised manner.

Statistical analysis

The χ^2 test was used to examine associations between categorical variables, with the χ^2 test for linear trend used for ordered variables with multiple categories. Multivariate analysis was carried out using Poisson regression model; an appropriate approach when analysing count data [16]. A value of $p<0.05$ was considered statistically significant. Statistical analysis was performed using SPSS software (SPSS Inc., Chicago, IL, USA).

Results

From January 2013 to January 2016, 10846 flexible sigmoidoscopies were performed, of which 7713 (71%) were included for analysis. Details on those excluded are noted in Figure 1. The baseline characteristics of the cohort are shown in Table 1. The median age at scope was 52 years and 50% of patients were male. The predominant indications for carrying out the procedure were PR bleeding (38%), altered bowel habit (17%), or a combination of the two (12%). Sedation was not used in 5963 (77%) patients and the majority of patients underwent enema bowel preparation (63%).

The maximum distance the scope was inserted to was most commonly the splenic flexure (34%), with 1217 (16%) flexible sigmoidoscopies being inserted proximal to this area. A total of 1172 (13%) patients had polyps and 298 (4%) patients had carcinomas.

Factors affecting maximum distance scope inserted

The influence of the baseline characteristics on the maximum distance scope was inserted is shown in Table 2. Endoscopists were more likely to reach the splenic flexure or more proximally in patients below 50 years of age (both $p<0.001$). There was also a significant relationship between gender and distance examined with male patients more likely to be examined proximal to the splenic flexure ($p<0.001$).

With regards to bowel preparation, the use of laxative preparation was increasingly important in examining more proximal distances (21% rectum vs 46% proximal to splenic flexure, $p<0.001$), as was the quality; with good/satisfactory bowel preparations required to visualise more of the bowel (64% rectum vs 88% proximal to splenic flexure, $p<0.001$).

Factors affecting polyp detection rate

Patients in whom carcinoma or non-neoplastic colorectal pathology was detected were excluded, and of the remaining 3003, 1831 (61%) patients had no polyps, 1057 (35%) patients had 1-2 polyps, 81 (3%) had 3-4 polyps and 34 (1%) had greater than 5 polyps. Factors that affected polyp detection rate are shown in Table 3.

On univariate analysis, age under 50 years ($p<0.001$), female sex ($p<0.001$) and the use of no bowel preparation ($p<0.001$) were associated with lower numbers of polyps being detected. These factors retained significance on multivariate analysis. With regards to bowel preparation, there were 3.45 (1.43 – 8.34, $p=0.006$) times as many polyps found when an enema was used and 3.81 (1.57 – 9.22, $p=0.003$) times as many were found if a laxative preparation was used, compared to using no preparation. The greatest number of polyps were found in sigmoidoscopies being carried out by consultant surgeons ($p<0.001$). In addition, multivariate analysis did not identify any association between the number of polyps found and whether sedation was used or not ($p=0.591$).

With regards to distance examined, there was an association with insertion of the scope more proximally and more polyps being identified ($p<0.001$). This was confirmed by multivariate analysis which indicated that 1.30 (1.04 – 1.63), $p=0.026$ times as many polyps were found when the scope was inserted to the descending colon compared to the rectum (Table3).

Region of most proximal polyp

Of the 1172 patients in whom polyps were found, the most proximal polyp was found in the majority of cases within the sigmoid colon (636 (54%) patients) (Table 4).

When inserted to the descending colon, the most proximal polyp was found within the sigmoid colon in 62% of cases. Similarly, when examining to the splenic flexure, the most proximal polyp was found within the sigmoid colon in 61% of cases. However, when the scope was inserted proximal to the splenic flexure, this proportion fell and the most proximal polyp was found within the sigmoid colon in only 46% of cases.

Discussion

The present study provides a comprehensive analysis of flexible sigmoidoscopy practice within our geographical area over a 3-year period, focusing on factors affecting the number of polyps found. It has shown that the number of polyps detected at flexible sigmoidoscopy is determined by both patient factors, such as age, sex and quality of bowel preparation; and also procedural factors, such as the maximum distance the scope is inserted.

The results of this study have shown that the number of polyps found varies depending on the distance of bowel examined. Whilst this would make sense intuitively, to our knowledge this relationship has not been quantified previously. The results of the present study have shown that the highest polyp detection rate was when the bowel was examined to the descending colon, with a fall in the number of polyps found more proximal to this. This is surprising as logical reasoning would expect the number of polyps found to increase as the bowel was examined more proximally. One explanation for this may be the patient population included in the present analysis overall. This is evident in the proportion of patients with polyps detected being below that of the UK Flexible Screening Sigmoidoscopy Trial [7]. The patients in whom more proximal scope insertion was carried out were more likely to be younger and female and hence were less likely to have polyps detected. Further work in an older population that may better represent the screening population is required.

Of interest, the present study identified that the most proximal polyp was found within the sigmoid colon in the majority of cases, even when the scope was inserted more proximal to this area. Examining up to and including the sigmoid colon would have picked up all the polyps within 1038 (88%) patients, and so, in the majority of patients it would appear to be of limited flexible sigmoidoscopy screening benefit examining the colon more proximally. As detailed above, the highest polyp detection rate was when the scope was inserted to the

descending colon, confirming the fact that the entire sigmoid colon has to be visualised to ensure efficacy of the test. Currently the definition for an adequately inserted screening flexible sigmoidoscopy is subjective and not clearly defined. For example, the definition in the UK Flexible Sigmoidoscopy Screening Trial aimed to progress as far as could be reached with enema preparation, no sedation and without causing significant patient pain [7], compared to the US study which aimed to reach 60cm [10]. Considering this, the overall data from this study suggests that screening flexible sigmoidoscopy should be inserted proximal to the sigmoid colon; at least up till the descending colon to ensure the most number of polyps are found. A positive examination would subsequently be followed by a full colonoscopy ensuring any polyps proximal to the descending colon are found.

In addition, this study has confirmed the finding of several epidemiological studies [17, 18] indicating that the incidence of polyps increases above the age of 50, with more than twice as many polyps being detected in these patients within the present study. Gender is also an established risk factor for polyps, with the findings of this study mirroring previous studies illustrating a higher prevalence of polyps within males [19]. It was of interest to note, however, that the present study did not identify a significant difference in the number of polyps found in patients that had received a laxative preparation compared to an enema. Laxative preparation is associated with increased discomfort, reduced patient compliance and more adverse effects than enema preparation [20, 21], and it is reassuring that the present study does not support its routine use. Although it was out with the scope of the present study to assess bowel preparation compliance levels, the overall levels of bowel preparation were rated as good/satisfactory in 84% of cases suggesting good adherence.

This study has a number of limitations. In particular, the present study relies on the endoscopists subjective knowledge of where they are within the colon or rectum. There are studies that have examined the accuracy of colonoscopic localisation [22, 23, 24], and

although the largest of these identified an overall accuracy of 96% [23] the majority of inaccurately identified lesions were within the sigmoid (47%) and descending colon (27%), the major areas of the colon visualised by flexible sigmoidoscopy. In our geographical area it is not routine practice to utilise the Scopeguide for flexible sigmoidoscopy which may aid navigation through the colon, nor is it routine practice to measure the distance in centimetres that the scope is inserted. Such additional information were it were to have been available would have added to the accuracy of the present study. For the purpose of the present study, it was also presumed that the endoscopist began each flexible sigmoidoscopy with the intention to intubate to the splenic flexure; however, due to it's retrospective nature this could not be confirmed. Furthermore, the present study included all polyps and did not differentiate between histological subtypes such as adenomata or hyperplastic polyps. Adenoma detection rate is of increased clinical importance due to a higher prevalence of hyperplastic polyps within the rectosigmoid colon. However, analysis examining this would have required additional linkage to pathology datasets, which was outwith the remit of the present study. Moreover, since rectosigmoid hyperplastic polyps have no significant malignant potential [25], experienced endoscopists are increasingly identifying them with high confidence and leaving them in-situ. As a result, a small percentage of such polyps may have been visualised but left within the colon; although it would still be standard practice to record these within the GI reporting system. In addition, endoscopist experience and speciality is of importance with regards to the overall efficiency of sigmoidoscopy. However, sub analysis within the speciality of the endoscopist was not possible within this study due to limited numbers.

In conclusion, the present study demonstrates that a variety of both patient and procedural factors can influence the number of polyps found during a flexible sigmoidoscopy. In particular age, gender, quality of bowel preparation and the distance of bowel examined are

of importance. There appears to be no significant difference in the number of polyps found comparing enema or laxative use. In addition, the most number of polyps were found when the scope was inserted up till the descending colon, with the most proximal polyp being found within the sigmoid colon in the majority of cases. Compelling evidence from randomised control trials indicate that flexible sigmoidoscopy may be an important screening modality in the future, with the results of this study providing information that could help better standardise its use in clinical practice.

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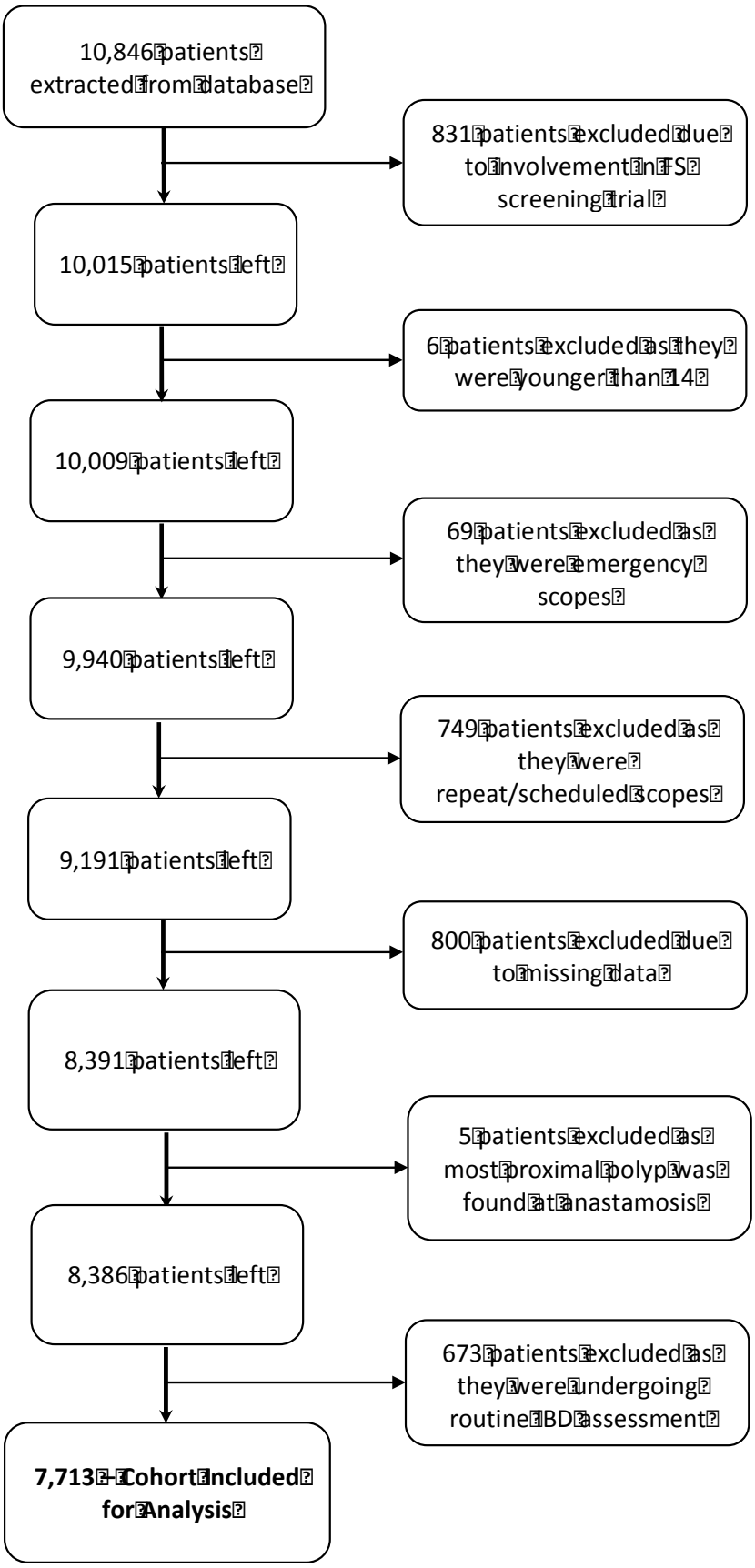

Figure 1: Patients undergoing flexible sigmoidoscopy in NHS GG&C (January 2013-January 2016)

Table 1: Baseline characteristics of cohort undergoing routine flexible sigmoidoscopy

	All patients n (%)
Age:	
<50	3682 (48)
50-70	2404 (31)
>70	1627 (21)
Gender:	
Male	3811 (50)
Female	3902 (50)
Indication	
Pain	330 (4)
Abnormal imaging	433 (6)
Altered bowel habit	1339 (17)
PR bleed	2924 (38)
Altered bowel habit & PR bleed	886 (12)
Previous polyp/cancer	573 (7)
Other	1228 (16)
Sedation	
No	5963 (77)
Yes	1750 (23)
Bowel preparation	
None	271 (4)
Enema	4867 (63)
Laxative prep	2575 (33)
Quality of bowel preparation	
Good/satisfactory	6500 (84)
Poor	1045 (14)
No bowel preparation	168 (2)
Maximum distance scope inserted	
Rectum	541 (7)
Sigmoid colon	1346 (18)
Descending colon	1954 (25)
Splenic flexure	2655 (34)
Proximal to splenic flexure	1217 (16)
Endoscopist	
Consultant surgeon	1561 (20)
Consultant gastroenterologist	1123 (15)
Nurse endoscopist	3831 (50)
Trainee	1198 (15)
Insertion limited by	
No limitation	6354 (82)
Discomfort	137 (2)
Poor bowel preparation	560 (7)
Pathology encountered	136 (2)
Intent of examination	489 (6)
Other	37 (1)
Pathology found	
None	1831(24)
Non-neoplastic colorectal pathology	4412 (59)
Polyp	1172 (13)
Carcinoma	298 (4)

Table 2: Factors associated with maximal distance of scope insertion during routine flexible sigmoidoscopy

	Rectum n (%)	Sigmoid colon n (%)	Descending colon n (%)	Splenic flexure n (%)	Proximal to splenic flexure n (%)	p-value
Age:						
<50	88 (16)	374 (28)	938 (48)	1696 (64)	586 (48)	
50-70	224 (41)	465 (35)	612 (31)	693 (26)	410 (34)	
>70	229 (43)	507 (37)	404 (21)	266 (10)	221 (18)	<0.001[a]
Gender:						
Male	304 (56)	615 (46)	898 (46)	1362 (51)	723 (59)	
Female	237 (44)	731 (54)	1056 (54)	1293 (49)	494 (41)	<0.001[a]
Indication						
Pain	18 (3)	33 (2)	98 (5)	125 (5)	56 (5)	
Abnormal imaging	48 (9)	142 (11)	102 (5)	71 (2)	70 (6)	
Change in bowel habit	42 (8)	199 (15)	342 (18)	492 (19)	264 (22)	
PR bleed	128 (24)	376 (28)	763 (39)	1221 (46)	436 (36)	
Altered bowel habit & PR bleed	24 (4)	112 (8)	208 (11)	418 (16)	124 (10)	
Previous polyp/cancer	108 (20)	196 (15)	126 (6)	72 (3)	71 (6)	
Other	173 (32)	288 (21)	315 (16)	256 (9)	196 (16)	<0.001[b]
Sedation:						
No	358 (66)	878 (65)	1545 (79)	2318 (87)	864 (71)	
Yes	183 (34)	468 (35)	409 (21)	337 (13)	353 (29)	<0.001[a]
Bowel preparation:						
None	71 (13)	89 (7)	60 (3)	22 (1)	29 (2)	
Enema	355 (66)	879 (65)	1332 (68)	1678 (63)	623 (52)	
Laxative prep	115 (21)	378 (28)	562 (29)	955 (36)	565 (46)	<0.001[a]
Quality of bowel preparation						
Good/satisfactory	344 (64)	912 (68)	1658 (85)	2520 (95)	1066 (88)	
Poor	155 (29)	380 (19)	259 (13)	121 (4)	130 (10)	
No bowel preparation	42 (7)	54 (3)	37 (2)	14 (1)	21 (2)	<0.001[a]
Endoscopist:						
Consultant surgeon	261 (48)	411 (31)	358 (18)	240 (9)	291 (24)	
Consultant gastroenterologist	80 (15)	266 (20)	335 (17)	220 (8)	222 (18)	
Nurse endoscopist	99 (18)	383 (28)	942 (49)	1952 (74)	455 (37)	
Trainee	101 (19)	286 (21)	319 (16)	243 (9)	249 (21)	<0.001[b]
Insertion limited by						
No limitation	298 (55)	783 (58)	1618 (82)	2536 (89)	1120 (92)	
Discomfort	8 (1)	58 (4)	65 (3)	3 (0.1)	3 (0.1)	
Poor bowel prep	77 (14)	280 (21)	168 (9)	18 (1)	17 (1)	
Pathology encountered	47 (10)	72 (5)	15 (1)	1 (0.1)	1 (0.1)	
Intent of examination	103 (19)	130 (10)	86 (4)	95 (10)	75 (7)	
Other	9 (1)	23 (2)	2 (0.1)	2 (0.1)	1 (0.1)	<0.001[b]
Pathology found						
None	89 (16)	229 (17)	413 (21)	732 (28)	368 (30)	
Non neoplastic colorectal pathology	247 (46)	700 (52)	1215 (62)	1628 (60)	622 (51)	
Polyp	95 (18)	297 (22)	295 (15)	280 (11)	205 (17)	
Carcinoma	110 (20)	120 (9)	31 (2)	15 (1)	22 (2)	<0.001[b]

(a – Chi-squared test for linear trend b – Pearson Chi-Square)

Table 3: Factors associated with the detection of polyps during routine flexible sigmoidoscopy

	Number of polyps detected				χ^2 p-value	Multivariate Analysis HR (95% CI)	P-value
	0 n (%)	1-2 n (%)	3-4 n (%)	≥5 n (%)			
Age:							
<50	1138 (62)	245 (23)	13 (16)	7 (21)		1	
50-70	479 (26)	461 (44)	41 (51)	15 (44)		2.01 (1.72 – 2.35)	<0.001
>70	214 (12)	351 (33)	27 (33)	12 (35)	<0.001[a]	2.22 (1.86 – 2.64)	<0.001
Gender:							
Female	1044 (57)	440 (41)	35 (43)	17 (50)		1	
Male	787 (43)	617 (59)	46 (57)	17 (50)	<0.001[a]	1.23 (1.10 – 1.38)	<0.001
Indication							
Pain	113 (6)	36 (3)	2 (2)	0 (0)		1	
Abnormal imaging	42 (2)	127 (12)	3 (4)	5 (15)		1.93 (1.35 – 2.76)	<0.001
Change in bowel habit	634 (35)	108 (10)	7 (9)	2 (6)		0.64 (0.45 – 0.91)	0.014
PR bleed	471 (26)	288 (27)	21 (26)	7 (20)		1.54 (1.11 – 2.14)	0.010
Altered bowel habit & PR bleed	241 (13)	40 (4)	6 (7)	3 (9)		0.96 (0.65 – 1.44)	0.857
Previous polyp/cancer	90 (5)	281 (27)	32 (40)	14 (41)		1.93 (1.38 – 2.71)	<0.001
Other	240 (13)	177 (17)	10 (12)	3 (9)	<0.001[b]	1.26 (0.89 – 1.77)	0.195
Sedation:							
No	1420 (78)	736 (70)	55 (68)	24 (71)		1	
Yes	411 (22)	321 (30)	26 (32)	10 (29)	<0.001[a]	1.04 (0.91 – 1.17)	0.591
Bowel preparation:							
None	37 (2)	5 (1)	0 (0)	0 (0)		1	
Enema	1172 (64)	611 (58)	42 (52)	22 (65)		3.45 (1.43 – 8.34)	0.006
Laxative prep	622 (34)	441 (41)	39 (48)	12 (35)	<0.001[a]	3.81 (1.57 – 9.22)	0.003
Quality of bowel preparation							
Good/satisfactory	1539 (84)	900 (85)	69 (85)	30 (88)			
Poor	272 (15)	154 (14)	12 (15)	4 (12)			
No bowel preparation	20 (1)	3 (1)	0 (0)	0 (0)	0.149[a]		
Maximum distance scope inserted							
Rectum	89 (5)	91 (9)	2 (2)	2 (6)		1	
Sigmoid colon	229 (13)	275 (26)	16 (20)	6 (18)		1.24 (0.99 – 1.55)	0.061
Descending colon	413 (23)	262 (25)	23 (28)	10 (29)		1.30 (1.04 – 1.63)	0.026
Splenic flexure	732 (39)	256 (24)	13 (17)	11 (32)		1.12 (0.88 – 1.42)	0.348
Proximal to splenic flexure	368 (20)	173 (16)	27 (33)	5 (15)	<0.001[a]	1.22 (0.96 – 1.56)	0.110
Endoscopist:							
Consultant surgeon	239 (13)	360 (34)	28 (35)	12 (35)		1	
Consultant gastroenterologist	374 (20)	159 (15)	14 (17)	9 (26)		0.75 (0.63 – 0.88)	<0.001
Nurse endoscopist	999 (55)	322 (30)	18 (22)	6 (18)		0.65 (0.56 – 0.76)	<0.001
Trainee	219 (12)	216 (21)	21 (26)	7 (21)	<0.001[b]	1.02 (0.87 – 1.19)	0.827

(a – Chi-squared test for trend; b – Pearson Chi-Square)

Table 4: Region of most proximal polyp

	Overall n (%)		Maximum distance scope inserted				
			Rectum n (%)	Sigmoid colon n (%)	Descending colon n (%)	Splenic flexure n (%)	Proximal to splenic flexure n (%)
Region of most proximal polyp:							
Rectum	382 (33)		95 (100)	109 (37)	76 (26)	64 (23)	38 (19)
Sigmoid colon	636 (54)		0 (0)	188 (63)	182 (62)	172 (61)	94 (46)
Descending colon/splenic flexure	124 (11)		0 (0)	0	37 (12)	44 (16)	43 (21)
Proximal to splenic flexure	30 (2)		0 (0)	0	0	0	30 (14)